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VOLUME 6, No. 3 MARCH 1954

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WORLD CROPS

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Editorial Comment

World wheat supplies and prices

THERE is anxiety in a number of countries concerning the future of wheat in view of the considerable surpluses that have arisen. The largest is of course in the U.S.A., where, according to President Eisenhower's recent statement, the Government's rigid price support programme has played the role of an umbrella for America's competitors and during the past two years has reduced sales abroad for American wheat from 224 million bushels to 64 million bushels, while during the same period Canada's sales on the free market have risen from 105 million to 161 million bushels.

According to FAO world production of wheat has enormously increased since the war. For the four major producing countries, the U.S.A., Canada, Argentina and Australia, the total production in 1952 was 66.9 million metric tons, which has further been augmented during the past year, as compared with 37.5 million metric tons before the last war. In European countries, excluding Russia, production has increased compared with the pre-war figure by 2.4 million tons.

Thanks to a favourable season record crops have appeared in a number of European countries last year, including oddly enough Italy where total production last year amounted to 8.8 million tons, practically enough to meet all that country's requirements for wheat, a record not previously surpassed even in the Fascist era, when great efforts were made to render the country independent of foreign imports.

In Australia, the wheat situation is apparently the subject of acute controversy. Sir John Teasdale, chairman of the Australian Wheat Board, is reported to have stated recently that the wheat industry is facing the greatest crisis that has assailed it since the depression of the 1930s and advocated a reduction of sowings until demand has overtaken supplies. He anticipated a surplus of 60 million bushels in 1954 and announced that his board contemplated sending representatives to Asian and African countries to negotiate sales. Other members of the Wheat Board are reported to have anticipated that the crop now being reaped would total 165-170 million bushels which, added to the existing surplus of 35 million bushels, would give a total of 200 million bushels to be disposed of.

As against this the Prime Minister, Mr. Menzies, stated on January 11 that the Australian Government believes that wheat acreage in Australia should be increased and not diminished. He considered that the world wheat situation had been made to appear worse than the facts justified; export prices were still well above Australian costs, and the Government is certainly not a party to acreage restriction. The Government was prepared to guarantee the export of up to 100 million bushels of wheat, at values which would not fall below the cost of production.

It is hard to arrive at a conclusion in the face of such conflicting views but it is to be borne in mind that history provides no examples of successful attempts to bolster up prices in face of very large stocks of a commodity over a prolonged period.

United States farm prices

PRESIDENT Eisenhower's message which he transmitted to the American Congress on January 11 will be considered by most observers outside the American orbit as a courageous effort to resolve a situation which the President himself considers to be as serious and complex as any which confronts the American legislature at the present juncture. It is to meet this that the new agricultural programme described in the message has been devised.

The crux of the matter in the President's own words is that in the U.S.A. 'present laws discourage increased consumption of wheat, corn, cotton and vegetable oils and encourage increased production.' Huge and growing surpluses held by the Government act as a constant threat to normal markets for these products. Partly because of these excessive stocks farm income has fallen steadily over the last three years, and because of the tremendous surpluses already in hand, acreage reductions and marketing quotas have had to be applied to wheat and cotton. Even these may not lower the surplus because increased yields will probably be sought from the reduced acreages, while the diverted acreages will probably be planted in other crops, thus aggravating the over-supply of vegetable oils, sugar beet, rice, alfalfa, flaxseed and other crops. The need is therefore to move without delay to deal with the fundamental causes of these surpluses of farm commodities.

The problem is not one of general over-production, for consumer demand continues at high levels, while prices for unsupported farm products are as high as those for price supported products. It is rather one of unbalanced production of specific price supported products, inevitable under the present rigid price support policy. It is complicated by the continuing and increasing loss of the foreign overseas markets on which America previously depended for much of its prosperity.

It must of course be admitted that the position is the cumulative result of the American creed which has for long sought to maintain agricultural prices at as high a level as possible for the benefit of the American farmer, and to safeguard him from competition by products from foreign countries, in order to maintain the standard of living in agricultural communities. In a community that is entirely self-supporting in all kinds of agricultural produce this may be a possible policy, but in one which is not and which depends on selling an appreciable fraction of its agricultural produce in overseas markets and at the same time seeks to exclude overseas competitive producers from participating in American markets, it seems obvious that a difficult situation is sooner or later bound to arise. In fact, it can be said that it has now arisen.

B1

Points in the President's programme

TO deal with the present situation the President's proposals are briefly as follows. (1) He proposes that the handicap of accumulated surpluses should be got over by sequestrating temporarily a part of the surplus commodities so that they will not enter into price support computations; (2) the legislation to be amended to ensure that the level of price supports be gradually related to supply, thereby promising farmers greater stability of income; and (3) in regard to the matter of parity, the modernised version of this computation is to be gradually adopted for all products, the process being completed by the beginning of 1956.

It is in regard to the last named matter that the main opposition to the President's proposals seems likely to arise. The underlying idea of parity itself is somewhat strange. Under the existing law, the Commodity Credit Corporation is bound to endeavour, to the best of its ability, to maintain the prices of various specified crops at different levels, decided by what is considered a fair farm income, which in turn is fixed by the ratio borne by farm prices to farm costs in the boom farming years of 1910 to 1914. The result was to give the farmer certain fixed advantages and under no circumstances were his prices to be allowed to drop below a certain percentage of the level of 1910-14, and by the term 'parity' this was meant.

Of recent years, a revised concept of parity has been accepted by Congress based on the relationship of the total available supply to the normal supply of a commodity; it is this modern concept of parity which it is sought to introduce for all commodities by 1956. Existing legislation, however, provides that until 1956 the old form of parity or the modernised form shall be used, whichever is the highest in fixing price support, but actually for all commodities except wheat, cotton, corn and peanuts the modernised parity is used.

The President is bound by an assurance which he gave to Americam farmers that through 1954 price supports on basic commodities at 90% parity was a moral and legal commitment which must be upheld, but the ultimate aim is the complete disappearance of the old method of calculating parity by 1956 and the provision of support price levels ranging from 75% to 90% of the modernised parity for certain products, notably wheat and maize, in that year coupled with the disappearance of mandatory price supports for some others after the end of 1954.

On the side of export production it is proposed that a series of trade missions should be sent overseas from the United States to Europe, Asia and South America to explore the possibilities of expanding international trade in food and fibre, while discussions are being arranged between the U.S. Secretary for Agriculture and the agricultural ministers of foreign powers on the subject of the disposal of American stockpiles and surpluses.

There are apparently so far no very definite plans for dealing with acreages diverted from cultivation in crops under control, but it is recognised that the question is a grave one and it is suggested that possibly agricultural conservation funds might be used to help farmers to make these adjustments in a way that would improve efficiency and help conservation. It is also recognised that the main beneficiaries of the price support policies hitherto have been the large mechanised farm units. The smaller farmers have derived little benefit from price support, and it is proposed to devote special attention to the problems of the small farmer.

In framing his proposals the President has had the benefit of the best expert technical advice available in the United States, and the programme is apparently based upon the widest advice obtainable. Unfortunately, it seems likely to become an acute political issue, in which issues may tend to become clouded by extreme partisan feelings. From any point of view except the political one the proposals seem to an outside observer to have everything to recommend them; in view of the importance to the world as a whole of a stable and productive American agriculture it is earnestly to be hoped that the President's efforts to provide a remedy for the present difficult and obscure situation may have a successful issue.

Farm electrification

IT is a common opinion that electric power on the farm is more convenient and cleaner but not cheaper than other kinds of energy. Inasmuch as this view is widely held, progress in expanding rural electrification schemes in the United Kingdom tends to be delayed for the economics of providing a supply in thinly populated districts rest heavily upon the amount of electricity that will in fact be used. If the farmer, when power becomes available, uses electricity for only those purposes for which it is outstandingly superior, the total consumption involved may not justify the installation. Yet there are tasks—steam raising and water heating, pump operation, power for grinding grain or running food mixers, etc.,—where electricity could displace solid fuel or the oil engine, for when costs are properly analysed, it is often found that electricity is in fact cheaper. Indeed electricity often offers greater economic advantages on the farm than it does in the small factory or industrial workshop, not because it is any cheaper in rural areas but because in the working conditions of many farms the costs of running small boilers or small oil- or petrol-driven engines are higher than normal.

The labour required for spasmodic attention to these can be costly, for a man may have to make several lengthy journeys from more continuous duties in the field to attend them: thus a solid fuel boiler can be wastefully extravagant if it receives irregular attention or requires frequent lighting-up. Unfortunately the full annual costs of operating solid or liquid fuel driven appliances are rarely realised by farmers. Recently a series of 'on-the-spot' cost comparisons was made by one of the regional Electricity Boards in England and the savings established by changing to electricity were remarkable. Steam raising on a dairy farm with coke was costing £125 per annum, including labour, but the cost, using electric power, was only £45-£50. On another farm where oil was used as the boiler fuel, a cost of £273 per annum was reduced to £192 by conversion to electricity.

Cooking food on a pig-farm using coal was costing £47 a year, but the cost using electricity was only £23-£28. Water-pumping at a small farm, powered by a petrol-engine, was costing £13 14s. 0d. per year; with electricity it was under £8. Economy as well as greater convenience and cleanliness can be achieved in many cases, and particularly on smaller farms. The townsman may be hesitant to accept this argument; to him, electricity is more convenient but not necessarily cheaper than solid or liquid fuel. The crux of the argument on farms is however the saving of labour involved, not merely the cost of actual time for attention to a boiler or an engine but also of the time spent in getting to and from the sites. Fuller appreciation of the range of economies that farm electricity can offer will speed rural electrification.

The spring demand for fertilisers

IT is a sign of the times that the Fertiliser Manufacturers' Association and the Superphosphate Manufacturers' Association in Britain recently found themselves impelled to organise a press conference at which they explained some of the difficulties they were experiencing in meeting the heavy seasonal demands for fertilisers in the United Kingdom and appealed to farmers to place their orders early in order to enable manufacturers to cope adequately and efficiently with the orders for fertilisers they are receiving.

The demand for fertilisers in Britain has expanded nearly fourfold since before the war and now amounts to over 4 million tons annually. This surely is a most comforting fact, having regard to the need for expanding British agricultural production, but it must be borne in mind that the bulk of this demand is for fertilisers to be applied in the early months of the year, notably in the month of March, and that to meet this demand within the time limit available taxes the resources of the manufacturers to the limit, both in the matter of the availability of materials and labour and also railway wagons or other forms of transport for the movement of the material to their destination.

To exemplify the magnitude of the task it was pointed out at the conference that three-quarters of the total amount of fertilisers supplied to the farmer today, or 3 million tons, have to be moved between mid-February and mid-April, which involves the movement of 5,000 10 ton railway wagons or 10,000 road trucks every day for two months, while the packaging and handling of this amount involves the handling of over a million bags of fertiliser daily.

It seems obvious that the greatly increased demand must to an extent have overtaken the manufacturers somewhat unexpectedly; it also seems obvious that such a situation must ultimately resolve itself but meantime it is clear that full co-operation between manufacturers should be the aim in order to achieve the most effective and efficient use of fertiliser production for the benefit of British agriculture. For this purpose the placing of orders for fertiliser by farmers early seems, as claimed by the manufacturers, to be an urgently desirable step.

Herbicidal shortcomings

IN a recent article in the *Fertilisers and Feeding Stuffs Journal* Prof. G. E. Blackman points out that herbicides have certain inherent shortcomings which must be taken into account when using them. It is true that some of these disadvantages such as direct toxicity to men and to animals as in the case of DNOC and DNBP can be guarded against by the exercise of normal precautions but in the case of some of the others unexpected difficulties may arise even from chemicals such as the hormone weed killers which are not normally regarded as toxic.

An example of this sort has recently been reported from Denmark where the extensive use of hormone weedkillers notably 2-4 D and MCPA and to a lesser extent dinitro compounds, are reported to have led to widespread destruction of bees. Studies at the Danish Bee Research Institute, Hillerod, have shown that mortality among bees increases with both dosage and concentration. The damage is reported to be minimised if spraying is carried out either before or after the blooming period of charlock and other free flowering weeds or under cold dry conditions when the bees do little foraging and the spray fluids dry rapidly.

In Denmark at present herbicides carry labels warning of this danger, and it is stated that legislation may be contemplated enforcing the payment of compensation for damage to bee stocks. It will be recalled that in earlier days the indiscriminate use of insecticides such as DDT for mosquito destruction had unfortunate results for the bee population in the U.S.A. and elsewhere, and the present case seems to be another example of unanticipated dangers arising from the unguarded use of new products, which justifies Prof. Blackman's warning.

Drought and dust in the U.S.A.

MOST people will remember the startling occurrences of the 1930s when American skies were darkened in the Eastern United States by the clouds of dust which were blown sky high by the wind in the region which became known as the Dust Bowl, and which more perhaps than anything else awakened public opinion in America itself and also vicariously in many other parts of the world, to the dangers of soil erosion and the need for conservation measures to check the losses incident on both wind and water erosion.

Those events were largely the culmination of a series of dry years in the Southern and Middle Western region of the United States; since then a series of more favourable seasons combined with the very active soil conservation policy adopted in the U.S.A. has done much to allay the alarm then awakened, but this year once again a threat of the return of the fearsome dust storms of the 1930s has made itself felt in the American South West following on a series of dry years which culminated in the excessively dry season of 1953, when the Rio Grande, the river which forms the southern boundary of the United States with Mexico, went dry for the first time in recorded history. In 13 states of the Union 527 counties had by early November been proclaimed as regions in which drought disaster conditions prevailed,

thereby entitling them to special aid relief measures from the Federal Government.

Much of the area affected is cattle country where the principal industry is stock raising; the relief has taken the form of the distribution of free supplies of fodder and the provision of facilities for moving livestock to areas not affected by drought aided by reduced railway freight rates and the purchase of stock by Government and its conversion into beef in order to remove surplus cattle from the market and to help to raise cattle prices.

Apparently soil conservation measures have helped to render the damage less serious than during the droughts and storms of the 1930s. Nevertheless the Soil Conservation Service reports that 5½ million acres in the Great Plains region have suffered moderate to severe erosion damage during the spring and summer of 1953. Part of this could have been avoided by better conservation practices but much damage was actually prevented by the measures instituted during the past 15 years.

Despite the remarkable progress in conservation practice the authorities agree that much still remains to be done to protect these lands adequately against erosion, and the farmers of the region, after enjoying a succession of favourable seasons, have had a rude jolt to remind them of the devastation which drought can bring in its train. As a result they are now reported to be actively stepping up their conservation measures against the time when still more severe drought conditions will recur. To this extent therefore the drought disaster of 1953 may in the end turn out to have been a blessing in disguise.

Soil and surface-active agents

CHEMICAL substances that alter the surface tension of liquids are used today in a diversity of industrial processes and as detergents in the home; they are also by no means unknown in agriculture for they have been employed as spreaders and wetting agents in insecticides, fungicides, and weedkillers. Their development as direct soil applicants is now regarded not only as practicable but highly promising. They have no effect upon soil structure and should not, therefore, be classified as a new kind of soil conditioner. They make it possible for the pores in the soil to be more readily wetted by moisture, and also for water to move faster through the smallest pores. Dry soils are likely to be improved by their use in that plants will suffer from wilting less speedily in periods of drought. The type of soil that tends to remain wet and heavy in the spring should also dry out sooner, thus helping earlier sowing and perhaps also hastening germination.

One such substance, a petroleum derivative developed by an American company, appears to have passed through its first field tests with impressive success. Yields of some crops have been raised appreciably, especially when the growth-period has been particularly dry. About 15 to 20 pounds are applied per acre. The effect is not long-lasting, as with the soil conditioning polyelectrolytes, for a surface-active substance is likely to be leached out of any fairly well-drained soil in twelve months. In addition to this private development work, the U.S. Department of Agriculture is studying the possibility of using surface-active substances to reduce the loss of moisture by evaporation from soils in subhumid and arid regions.

The traditional role of bulky organic matter would seem to be facing yet another chemical challenge. If soil conditioners have been put forward as substitutes for the soil-binding constituents of humus, surface-active substances might be regarded as substitutes for mulches even though their influence is exerted within the soil rather than on the top of it.

N.A.A.S. research

THE extent to which the work of Britain's National Agricultural Advisory Service is experimental is far from fully appreciated. Certainly the idea that the organisation is a mobile form of enquiry bureau handing out standard answers to routine questions and passing the awkward queries on the established research stations is grossly incorrect. From the early days of the N.A.A.S. there has been an enterprising readiness to co-operate experimentally with farmers and growers whenever difficult cropping problems have been raised. Now that experimental stations and farms run by the N.A.A.S. are coming into active existence, the research approach is rapidly expanding. Many of these new centres, including one or two demonstration stations, issued reports for 1953. For the most part these reports were called farm or station guides for they could do no more than describe the experiments initially laid down; results being still in the lap of time and presumably the ' guides ' will later be called, as they should be, ' reports.'

One centre where experimental work is already yielding results is the Luddington Horticulture Station, Stratford-on-Avon, and although its report speaks of general development continuing slowly the number of experimental projects in active operation is impressive, covering such diverse matters as the effects of screens of wire netting, fencing, and straw bales upon earliness, quality, and yield of vegetable crops; the influence of planting and thinning methods upon cut flower yields; the effect of fertiliser placement on a range of vegetables; a long-term study comparing the merits of bulky organic treatments and inorganic fertiliser applications; the effects of Dutch light orientations—North-South or East-West—and the different slopes of glass upon forced lettuce production; crop spacing influences on various vegetable yields; various disease control studies; vegetable variety and fruit rootstock trials. A programme such as this would not seem sparse for a long-established research station, and it is clear that within a year or two reports from several other N.A.A.S. experiment farms and stations will reveal equal operational activity.

When it is remembered that the early years of even such famous centres as Rothamsted, Long Ashton, and East Malling carried smaller-scale experiment programmes than these, it is not exactly fatuous to wonder just what the total scale of agricultural and horticultural research will be in Britain by, say, 1975. Research centres rarely disappear or contract; their natural history is almost invariably one of success and enlargement. The prospects for vast strides forward in cropping technology seem almost too promising.

Characterising Spraying Nozzles

R. J. COURSHEE, B.Sc.

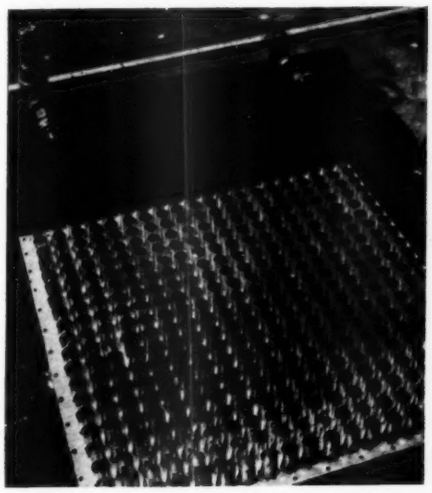
National Institute of Agricultural Engineering

Measurements of the performance of spraying nozzles are now being undertaken to obtain basic information on atomisation and to accumulate design data for the use of these nozzles in making machinery for pest control. The following account has been prepared to show what measurements are made, the equipment and methods used and some of the results.

AN examination of commercially available nozzles seemed desirable because few measurements had been made and manufacturers of spraying machines were compelled to make their nozzle choice without evidence.

A nozzle is needed in a spraying machine to convert the solution or dispersion into fine drops so that a thin, even cover of toxic material may be obtained on the plant. Also the nozzles usually occupy a position, relative to the crop, which is chosen with care to give the required uniformity of dosage rate over the zone covered. For designing spraying machines, measurements of atomisation and distribution, and of the liquid throughput are the most important. The following factors are also recorded qualitatively, however: corrosion resistance; abrasion resistance; practicability, *i.e.* robustness and freedom from blocking; working pressure range; price; adjustability to suit conditions and replaceability of wearing parts.

Also, in order to enable operators to understand more clearly what is happening in the process of breaking up the liquid and, on occasion, to design a nozzle when a suitable one is not already commercially available, high-speed photographs of the breakup are taken in air or in a chamber where the atmospheric conditions may be varied. Accordingly the performance of a nozzle therefore becomes measurable under a variety of operating conditions using liquids having different physical properties.



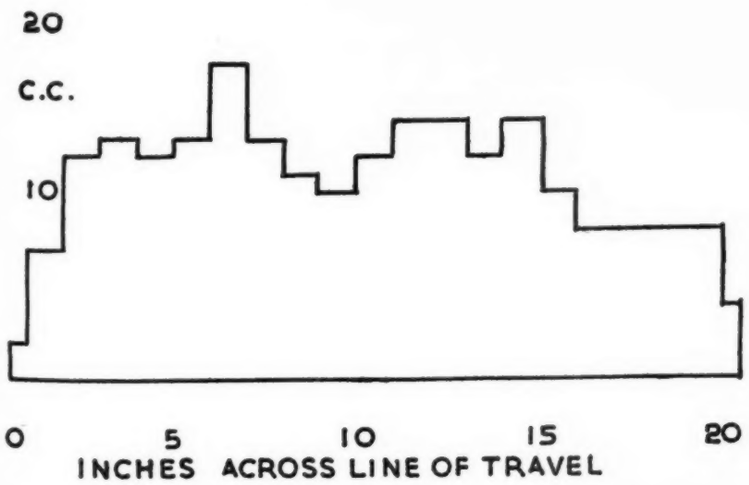


Fig. 1 (*Top*) — **A nozzle patternator. The liquid delivered into each can is measured in order to draw spray distribution graphs. Fig. 2—Distribution graph**

Types of nozzle*

The most widely used nozzles are worked by hydraulic pressure (30-600 p.p.s.i.). They comprise (1) the swirl nozzles where the liquid is caused to rotate in a spiral groove (the swirl plate) and issues in a rotating conical sheet, and (2) the fan nozzles wherein a flat sheet is formed by the shaping of the final orifice. It may be noted that the function of nozzles is to form a sheet of liquid since small drops are more readily formed from a sheet than from the rod which gives rise to the sheet.

A simpler method of forming a sheet is to direct the liquid stream against an obstacle called an ' anvil,' but nozzles using this principle have not yet been used widely for insecticide spraying and are more suited for irrigation sprinkling and for fire-fighting.

Swirl nozzles are better generally than fan nozzles except in the matter of cost, but where the target is a young cereal crop or similar low even growth their superiority is only small.

A second major class of nozzles which is typified by the Dekker, Agro and Alexander nozzles is that in which the air is moved and the liquid nearly still. Such air blast nozzles are, of course, of value where an air stream is available to carry the drops once formed into the crop. This is especially important for low volume spraying.

In the agricultural sphere a new range of nozzles are the rotating nozzles in which the break up is caused partly by the high speed of rotation of the nozzle. These are used mostly in English agriculture for indoor spraying and orchard spraying. One, however, on which a spinning cup is rotated by a propellor attached to it driven by the air stream, is also finding wide use in crop spraying abroad in countries of larger fields than those used in Great Britain.

Equipment and methods

The Nozzle Patternator. With the majority of nozzles and under normal working conditions the break up occurs as a result of the liquid moving through the surrounding atmosphere which is at rest relative to the nozzle. The easiest, and probably the best, way to measure the

* See WORLD CROPS, Vol. 5, p. 321.

throughput of this type of nozzle is to spray into a bucket for a known time and measure the volume of liquid. When fine drops are formed and where an air stream is used to cause the break up of the liquid this method cannot be used however and, instead, the time taken to spray a known volume is measured.

Similarly when trying to find out where the spray goes to, the most simple method, which is also quick and accurate, is to spray into cans of measured sectional area spaced at known intervals. Accurately stamped cylindrical cans placed in equally spaced holes drilled in a sheet of aluminium are used and the nozzle is positioned above the cans and allowed to spray into them for a measured time. (Fig. 1.)

The results are recorded as a series of numbers of c.c.s per can on squared paper (Table 1). When a nozzle is mounted on a spray boom and drawn forward with the speed of the spraying machine those parts of the spray ' pattern ' which fall in line spray the same area in turn. So the dose which would be deposited by a moving nozzle can be computed for different nozzle orientations by adding the figures from the patternator which are in line with the direction of travel. Usually fan nozzles similar to that for which the results are given in Table 1 are arranged with the minor axis of the elliptical sprayed area parallel to the motion and the corresponding dosage rate curve is shown in Fig. 2.

To show that these results are of more than academic value, patterns from other nozzles are shown in Fig. 3—these may be criticised since the distribution of the spray is uneconomic, as overdosed and underdosed areas lie side by side. Fig. 3b also shows a common fault of fan nozzles in the wasteful large dose of material occurring at the sides of the sheet which is also dangerous in that it is a sufficiently excessive dose to damage the crop.

When the spray is formed by an air blast nozzle the air stream also carries along the spray and the method of estimating the spray content of the stream at different points must be chosen carefully to avoid disturbing this distribution and the lines of flow.

The Riley Sprayograph. Often a pictorial demonstration showing the nozzle pattern has a more telling effect on the farmer and the manufacturer than a table of figures. The pattern of the nozzle can be shown adequately on blotting paper using a dyed liquid providing the exposure of the paper to the spray is sufficiently brief to avoid overlapping of the stains formed. To get this short exposure the blotting paper is placed inside the loop of the endless belt of the Riley Sprayograph (Fig. 5) in which there is an adjustable slit which, as it moves over the paper, allows the nozzle above to spray through for a short time. Fig. 4 shows the pattern corresponding to Fig. 3b and the preponderance of large drops at the edge of the spray causing the excessive dose there. It is clear from the photograph how the smaller drops (less than 100 microns) in the spray are diverted from their original path by the air stream caused by the moving belt.

To show what would happen if the nozzle were moved over the crop the blotting paper is moved instead by attaching it to the surface of the belt. At the speed at which the spraying machine usually travels, the paper is so densely covered with spray that it is impossible to see the pattern. The belt is therefore moved at the higher speed of 12 m.p.h.

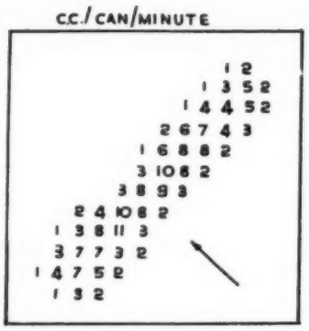


Table 1—Result of patternator test

Drop size measurements

There are three problems in measuring the drop sizes formed from a nozzle. These are:

1. Obtaining a manageably small sample of the total spray which is an accurate small fraction of the total—it should be what is called a representative sample so that if 10% of the spray is formed of drops lying in the size range of 100 to 110 microns (one micron is equal to one twenty-fifth of a thousandth of an inch) 10% of the sample also lies in the same size range.
2. Secondly, it is difficult and often inconvenient to preserve the drops in their original spherical form. It is generally more suitable to allow them to strike a solid surface and flatten into a circular stain. The second problem is therefore to determine the relationship between the size of this stain and the size of the drop from which it was formed.
3. The third problem is, once we have all these hundreds of stains on a piece of absorbent paper or on a glass slide, how to find time enough to count them.

It is important to be able to measure the drop size from a nozzle for many reasons. The finer the spray the more com-

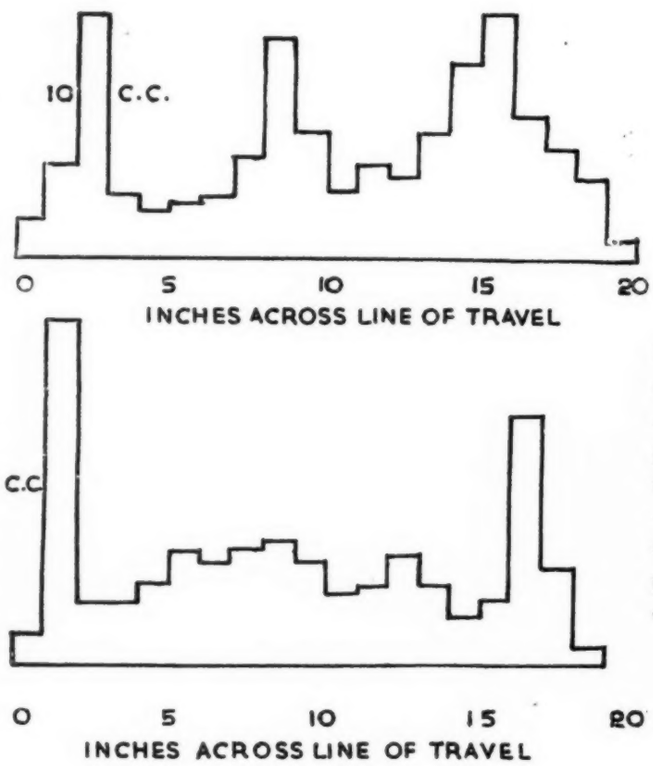


Fig. 3 (*top*) — **A distribution graph from a fan type nozzle giving an irregular deposit. Fig. 3b** (*below*) **—A distribution graph showing the edge peaks characteristic of fan type nozzles**

plete the coverage obtained. This is of special value when using high concentration sprays and only a few gallons to the acre and also where the crop is dense and has a large leaf area. On the other hand, excessively small drops are both wasteful and dangerous since they cannot be relied upon to land where they are aimed. When using hormone type weedkillers the drift of small drops with the wind must not be towards any susceptible crop. A method of spraying called drift spraying, whereby the spray is spread using the wind to carry it, is critically dependent upon the use of the correct drop size for accurate work. At the other end of the scale the largest drops are particularly liable to cause damage partly through the physical impact of the heavy drop and partly through high local overdosing at the point where the large drops land. Over a range of sizes insecticidal effectiveness may be altered by particle size. It is necessary to know exactly what the available nozzles can do, also, in order to produce a nozzle giving a better result, if necessary.

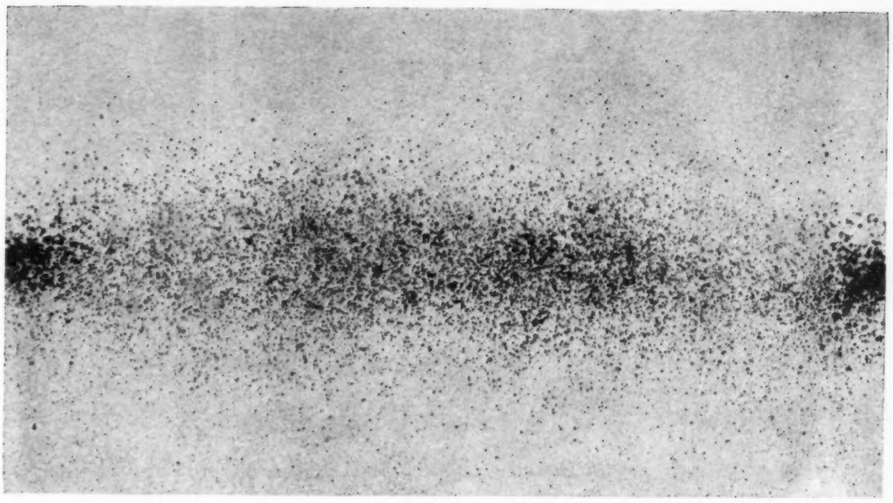


Fig. 4—Pattern corresponding to the distribution graph of Fig. 3b. The drift of small drops to one side can be seen

Sampling

Two methods are used to obtain a small representative sample of the spray from a nozzle. Both are based on exposing the receiver to the spray for a short period of time.

To measure the large drops given by an ordinary flat or swirl nozzle, the spray is directed into a draught proof chamber (so that no small drops are blown away) for one-fiftieth of a second. The timing is arranged simply by mounting the nozzle on a rotating arm so that it sprays in all directions in turn and at one point the spray goes through a narrow slot into the receiving chamber (Fig. 6). The velocity with which the nozzle tip moves is just over one mile per hour so there is little fear that the performance will differ from that of the same nozzle stationary. The spray then falls on to the slides arranged at floor level. The main precaution to be taken is to ensure that the slides are flush with the floor because if they protrude above it there is a tendency for smaller drops to avoid them.

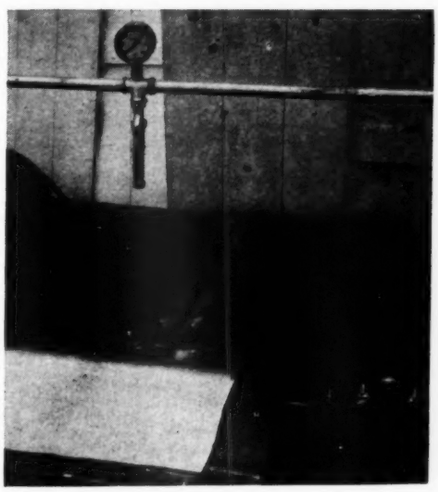


Fig. 5—A 'Riley' sprayograph used to allow a short burst of spray to land on the paper below the belt. This gives a picture of the spray pattern from the nozzle

The same tendency to avoid the slide is very much more marked when nozzles suitable for forming a very fine spray are used. The tiny drops settle only slowly and are liable to evaporate in mid-air if they take more than a few seconds to land. They also tend to flow with the air round a slide placed squarely in their path. Therefore we use a carefully streamlined volume sampler (Fig. 7) which is, by means of an electrical control, opened at the front and the back for a variable time interval, thus allowing a volume of spray laden air to enter. On closing the sampler, the spray settles undisturbed on the slides at the bottom. This sampler appears satisfactory for drops larger than 10 microns in diameter. Smaller drops tend to leak in the gaps round the openable shutters but since they are of little importance for agricultural purposes they need not concern us here. This type of sampler is used at present for air blast nozzles similar to those of the Agro sprayer. These are valuable nozzles in their simplicity, freedom from blockage and in the efficiency with which they atomise the spray even when it is a thick slurry of DDT in water.

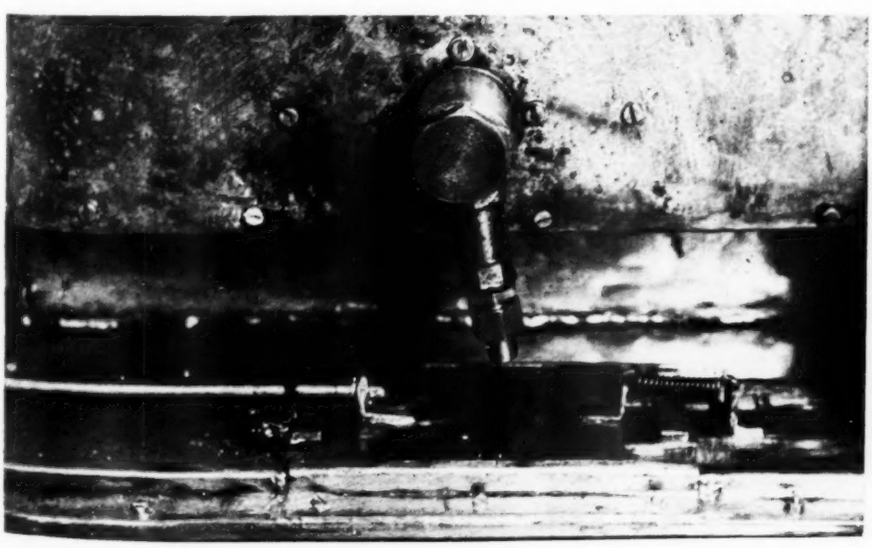


Fig. 6—The nozzle under examination is bolted to the rotating shaft and sprays through the slot. The spray passing through is collected in slides in a draught-proof box below

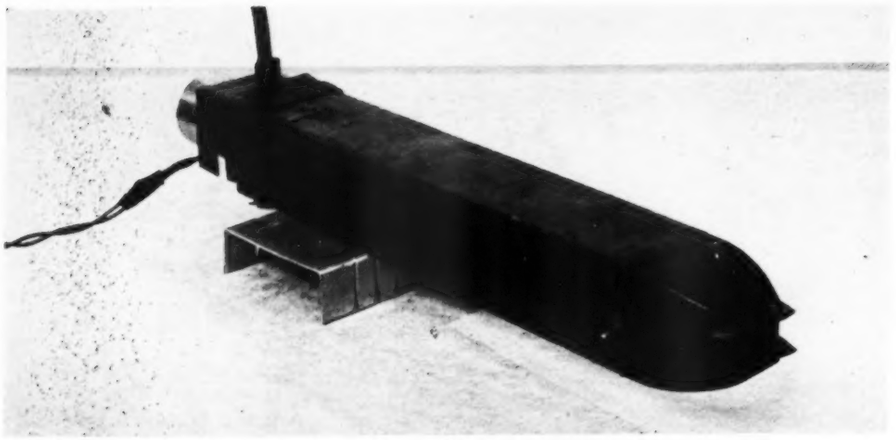


Fig. 7—A spray sampler with streamlined jaws shown opened by the electromagnet at the rear

Stain size interpretation

The most simple and widely used method of recording the size of the coloured drops formed is to allow them to fall on standardised absorbent paper (on which they form a circular stain). This is satisfactory for large drops (greater than 100 microns) but below this size the fibres of the paper distort the stain so that it is no longer approximately circular. A further, small, disadvantage is that the stain size is not linearly proportional to the drop size and therefore we are unable to measure the mean drop size directly from the mean stain size.

The method we have chosen for water sprays after a lot of trial and error experiments is to receive the drops on a glass slide coated with Autobrite car polish, which is a solution of a silicone mixed with a fine cleaning powder. The slide is thus cleansed and recoated with a silicone film on which the drops spread to a known extent. The water spray is dyed with an I.C.I. chemical called Nigrosine G.140, which is of an intense black colour and forms round sharply-defined stains. The advantages of the Autobrite slides are (1) that they may be viewed with either transmitted or reflected light (which is an advantage), and (2) that the performance is independent of weather conditions or how the silicone is applied or who applies it. It is also cheap and easy to use. We have calibrated the method for droplets up to 500 microns in diameter.

The calibration is done by measuring the stain size and the drop size side by side. The drops are caught in a mixture of vaseline and medicinal paraffin and quickly covered with a film of medicinal paraffin to make them spherical and prevent them evaporating. The necessity for speed is illustrated by the evaporation curve (Fig. 8) of a typical drop half-embedded in the grease mixture. The proportions of vaseline to paraffin are varied slightly to suit the room temperature.

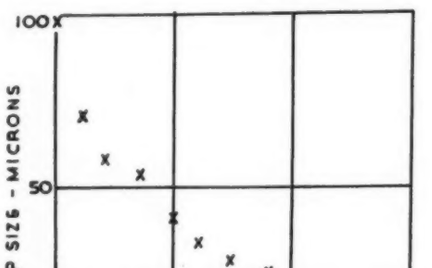


Fig. 8—Drop evaporation rate at room temperature

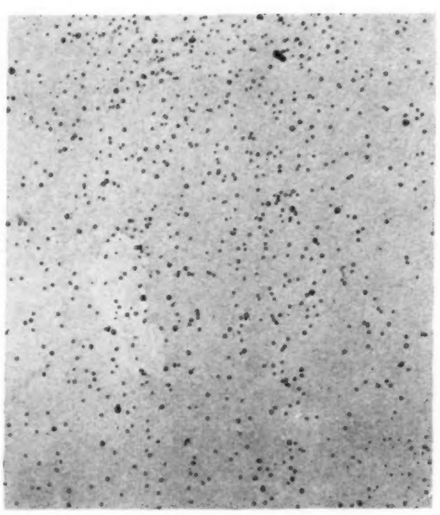


Fig. 9—A spray sample of dyed water on absorbent paper

Sizing

An obstacle to the progress of both nozzle testing and the development of spraying machines was that too much work was involved in measuring the mean size of drop of a sample like that of Fig. 9. Therefore we had to make a machine to do it for us. This was done at the Post Office Engineering Research Station. The machine is based on a mechanical method of scanning the sample in straight lines so that the machine's electric eye sees each part of each stain in turn and records on a series of counters how many stains are in each of ten size ranges. With a little arithmetic the mean stain size and therefore the mean drop size may be worked out. In addition, the coverage and dosage rate may also be measured automatically and quickly. It is necessary that the background should be white and the stains black and opaque for use in this counting machine and the Autobrite car polish on clear glass was chosen with this object in view.

The major factors of distribution of material across the sprayed band and of drop size can therefore be measured. Such problems as resistance to corrosive sprays and to abrasion by both the liquid and any dispersed powder in it are considered only qualitatively since the brass and ceramic nozzle tips seem adequate to resist corrosion. Newer materials may increase the useful life of a nozzle—the advantage is not the saving in nozzle costs but the maintenance of a high standard of performance so that the imperceptible decrease resulting from erosion does not occur to waste costly insecticides and fungicides.

It appears at present that the saving of materials and time are the most likely sources of profitable results from this work, either as a result of getting the same yield increase as at present with a smaller expenditure or by achieving a better result for the same cost.

Photos: National Institute of Agricultural Engineering.

British Agricultural Representative in New Zealand

Mr. E. G. Griffiths, B.Sc. (Agric.), has been appointed Agricultural Adviser to the United Kingdom High Commissioner in New Zealand and arrived in Wellington on January 9. He is succeeding Mr. Donald S. Hendrie, B.Sc. (Agric.), N.D.A., N.D.D., who is returning to the United Kingdom.

Since May 1949 he has been Assistant County Agricultural Officer (Advisory) to the Norfolk Agricultural Executive Committee.

The Cashew Nut

A. E. HAARER, F.L.S.

The cashew nut is steadily gaining popularity in many parts of the world. In this article, the characteristics of the plant are described and discussed and indication given of how the cultivation of the tree as a crop might with advantage be extended.

AMONG crops which of late years have assumed increasing economic importance is the cashew nut (*Anacardium occidentale*). The product is the fruit of a small tree, a member of the family Anacardiaceae within the natural order Sapindales. The country of origin is Brazil, whence it has spread to the majority of tropical countries: in the early stages its spread was assisted by the early Portuguese navigators. It has accommodated itself so well to conditions in some of the countries to which it has been introduced that it has become almost subspontaneous in favourable situations. Actually, the countries in which it has obtained the greatest extension are India, Ceylon, British East Africa and Portuguese East Africa, from all of which there are considerable annual exports; there is also a small annual export production from Brazil, Egypt, the West Indies and several other countries.

Description of the tree

The cashew nut tree is a compact low-growing tree with darkish green foliage. Under high rainfall conditions it may grow to a height of 40 ft., but normally is much shorter.

The product of the tree of economic importance is the nut which is very oddly shaped and is enclosed in a hard green shell. The nuts are attached to a swollen pear-shaped leaf stalk which may run to several inches in length and thickness, known as the cashew apple, the whole presenting an unusual and striking appearance. To the uninstructed the pear-shaped leaf stalk appears to be the fruit, it is golden yellow in colour and looks inviting to the eye. It is in fact pulpy and full of juice but very fibrous in texture, with a sweet, slightly-acid astringent taste; it is widely eaten by native Africans and Indians but is too astringent for the European palate. The juice contains as much as 9% of sugar, makes a refreshing beverage and can be fermented to make an alcoholic drink or ' wine.'

The nut

The nut is the main product of commercial value, and it requires to be separated from the outer shell which contains a poisonous and irritating oil; so irritating is this oil, in fact, that it is impossible to extract the kernels by hand until the nuts have been roasted, and this constitutes the usual peasant cultivators' method of treatment. The shell oil, however, also has a commercial value, and the modern method is to treat the outside shells in a factory by a solvent extraction process to extract the shell oil, after which the shells can be cracked and the kernels extracted.

A cluster of cashew nuts

The kernels themselves are edible and are becoming increasingly popular in countries all over the world by reason of their pleasant flavour. In composition, they closely resemble ground nuts. The following table gives the average analytical characteristics of both and shows strikingly the resemblances.

TABLE 1

Composition and Percentage	*Cashew Nut*	*Ground Nut*
Water	5.2	7.4
Protein	12.1	29.8
Fat	44.3	43.5
Carbohydrates ..	17.0	14.7
Crude Fibre	1.3	2.4
Ash	2.6	2.2
Estimated calorific value ..	531	587
Shell or refuse ..	70%	27%

Cashew nut oil consists mainly of the glyceride of oleic acid with some linoleic, as well as small amounts of palmitic and stearic acid; it closely resembles sweet almond oil.

Production

Formerly, cashew nuts were derived entirely from trees which had been casually planted or were self-sown, but latterly there has been an increasing tendency to establish commercial plantations, particularly in the South-Eastern Province of Tanganyika, where production is increasing rapidly: at present production is mainly in the hands of African peasant growers but a number of European settlers are also developing plantations.

The tree is often planted in avenues bordering roads or along the boundaries of estates; they are also often planted in the vicinity of schools and homesteads.

Planting

The ideal conditions for the crop are sandy loam soils, an annual temperature range of from 60°F. to 90°F. and a rainfall of 30 to 50 inches per annum falling within a well-defined wet season and alternating with an equally well-defined dry one. Under such optimal conditions cropping is steady and good, but if the environment is too moist yields tend to fall off.

For the reason that cashew seedlings have a long tap root and do not do well when transplanted, the usual practice is to plant seeds at stake. Germination usually takes place in about a week; growth is fairly rapid and the young trees may begin to yield when they are two to three years old. It is usual to establish plantations at 20 ft. apart and to thin them down as they grow older to a 40 ft. spacing. This enables a certain amount of selection to be performed and to leave the most productive trees, the fact that it may lead to a little unevenness in the plantation spacing is of no great moment.

During the early years catch crops can be grown between the lines of cashew trees, provided they do not compete with the young trees and overshade them. By the fifth year the trees should be giving an economic yield, and in the tenth year they should be in full bearing. Once trees have become established they need the minimum of attention. If they are

Cashew nut trees by the wayside in the South-Eastern Province, Tanganyika Territory

properly spaced they shade the soil and weed growth is largely arrested; on this account weeding is unnecessary and all that is needed is to slash such weeds as occur occasionally, particularly before the nuts begin to fall.

There is a great variability in the trees themselves and the character and quality of the nuts they bear: it is probable that there is ample scope for selection of the best trees and their propagation vegetatively by budding or grafting, in order to ensure uniform high yields of good quality nuts.

Harvesting

During the season when the crop comes in, the nuts are produced and hang in clusters among the ever-green foliage. In India, the nuts are harvested during the months of March, April and May, usually with the aid of knives tied to sticks, though this entails the harvesting of a number of immature nuts which are used by the growers in curries. In East Africa, the nuts are allowed to ripen on the tree and fall to the ground, whence they are gathered at regular intervals. This at least ensures that the crop is fully mature and there is little or no loss of crop if the ground is kept reasonably clean.

Yields

The yields may run up to 100 lb. of nuts per tree annually. In India, it is stated that on the west coast they average 20 lb. per tree, in Madras 30 lb. per tree, and in Orissa 40 lb. per tree.

Extraction and processing

The crude peasant method of extracting the nut is very simple; the nuts are placed in a large pan or tray over a brisk fire and about three dozen are roasted at a time. The nuts are stirred with a metal rod from the windward side, and this causes the volatilisation of the irritant shell oil, which usually bursts into flame. The flames are quenched before the inner kernels can become charred, the essential point being that the volatile shell oil should all be volatilised, after which the nuts can be extracted from the shell by using a small mallet to crack them open.

Factory extraction of the shell oil is practised in India; it is so far the only country in which factory processing is carried on. Hitherto, a large proportion of the cashew nuts produced in Ceylon and East Africa have been shipped to India for processing and extraction. Since Ceylon nuts are in season from April to July and East African nuts from December until March this enables the Indian factories to work almost continuously the year round.

The process of extraction consists in passing the whole nuts contained in wire baskets through a bath containing a solvent oil heated to 370°F.-380°F., after which the nuts can safely be passed to labourers to be extracted by hand. After extraction, the kernels are graded into mature, immature or broken grades. At present about half the nuts exported from India come from East Africa, but factories for the extraction of cashew nut oil are now in course of erection in Portuguese East Africa and near Mtwara Port in Tanganyika, which will probably lead to a reduction in the export trade.

World trade in cashew nuts

International trade in cashew nuts has developed almost entirely during the past three decades. In 1925, exports of cashew nuts from India did not exceed 50 tons, but by 1941 they had risen to close on 20,000 tons. Of total exports, nearly 80% are taken by the United States, the remainder going mainly to the United Kingdom and Australia. In East Africa, production of cashew nuts has increased steadily of recent years, particularly in the South-Eastern Province of Tanganyika. The following table shows how production has expanded:

TABLE 2

Production of cashew nuts in Tanganyika

	Tons
1947-48	3,461
1948-49	2,332
1949-50	3,112
1950-51	6,965
1951-52	7,821
1952-53	11,196

It is understood also that efforts to develop the production of cashew nuts in Nigeria are in progress.

Cashew nut shell oil

The production of cashew nut shell oil has so far only established itself in India. The oil itself possesses drying properties. On heating or on exposure to air the constituents polymerise to a rubber-like substance. On this account it is used in paint manufacture, while in India it is used for waterproofing fishing lines and fishing nets and similar purposes. It is mainly exported to the U.S.A.

Conclusion

There seems good reason to believe that the production of cashew nuts as a crop could be extended with advantage, notably in countries of low to medium rainfall which are liable to drought from time to time and consequent periods of food scarcity, since yields are not greatly reduced in dry seasons, except in exceptional cases. During periods of drought, therefore, they could prove a valuable insurance against famine. It is in fact seldom realised how greatly a permanent crop of this type could contribute to the food supply of a locality, in addition to forming an article of export of which the popularity seems almost certain to increase. In addition, the planting of the tree on sloping land liable

(*continued on page* 98)

American Maize Rust in Africa

D. RHIND

The recent appearance in Africa of a rust disease hitherto only known in the Central American region, which in Africa has assumed a virulence which it did not previously possess, is an occurrence which has occasioned some concern. The following account of the position has been prepared for WORLD CROPS *by Mr. D. Rhind, formerly Secretary for Agricultural Research in West Africa and now Secretary of the Colonial Agricultural Research Committee.*

THREE diseases of maize caused by rust fungi are known. One of these is cosmopolitan in its distribution and probably occurs wherever maize is grown. This rust, *Puccinia sorghi* Schw., seldom does much damage though, occasionally, it assumes epidemic proportions when conditions are specially favourable to it. The other two rust diseases of maize were confined to the Central American region up to 1949 when one of them (*Puccinia polysora* Underw.) was found to be causing a rust epidemic on maize in Sierra Leone. The third rust (*Angiopsora zeae* Mains) still remains confined to the Central American area.

Spread of *P. polysora* to West Africa

The discovery of *P. polysora* by Deighton in the West African territory of Sierra Leone in 1949 opened a new chapter in the story of the maize rusts. So long as this rust remained in its original home it does not seem to have caused serious damage, but when it invaded new territory in Africa its attacks were much more virulent. After crossing the Atlantic, by what means can only be conjectured, *P. polysora* spread rapidly eastwards along the West African coast. It caused severe epidemics in the Ivory Coast, Gold Coast, Dahomey and parts of Nigeria in 1950, 1951 and 1952. The losses of crop were very severe in the high rainfall areas, particularly on crops which were sown late and which reached the flowering stage at a time when there were abundant uredospores from infections on early sowings. Losses ranged from a few per cent. up to total loss of the crop, the overall loss of grain in 1951 being probably not less than 40% in West Africa, where it caused local food shortages. Even when a partial crop was harvested, the grain was undersized and of poor quality.

Attacks usually became severe only when the crop was well advanced and the rainfall fairly heavy. Early-sown crops escaped the most severe damage, while late-sown crops were often a total loss. Only one or two varieties showed slight resistance although one late-maturing variety (Tsolo) from Griqualand showed some degree of hypersensitivity.

Remedial measures

By 1951 it had become clear that a new problem had arisen in Africa, and that this rust disease, of little account in its original habitat, was attacking with a virulence which was affecting food supplies. The intensity of attacks could not be ascribed to specially favourable climatic conditions because they covered too great an area which included a considerable range of conditions. Records of collections of fungi made it certain beyond reasonable doubt that this parasite was not present in West Africa before 1949 and probably only reached the Gold Coast and Nigeria in 1950. Clearly something had to be done about it because it had evidently come to stay and West African maize was unable to resist its attacks. The Colonial Office, with the concurrence and participation of the four British West African territories, decided to set up a research unit at Ibadan to study this rust and, if possible, to breed resistant types if a basis of resistance could be found. Before this research unit was assembled the Nigerian Department of Agriculture had collected a number of varieties of maize which included some from the Central American region. By good fortune some types from Mexico and Venezuela were found to show high resistance to *P. polysora*, thus providing the essential basis for a breeding programme and incidentally another example of the soundness of Vavilov's theory of the origin of genes.

Once well established in West Africa it seemed inevitable that this rust would spread into other parts of Africa where conditions suited it. What exactly those conditions are is still uncertain, though the fact that it remained confined to the warmer parts of Central America and did not spread into cooler areas nor into areas of cold winters, gives hope that it is more limited in its adaptability than the common *P. sorghi*. However this may be, it was thought advisable to test varieties from other parts of Africa for possible resistance and a number from East Africa were grown at Ibadan in 1952. They all proved to be fully susceptible.

Spread to East Africa

About the middle of 1952 *P. polysora* had crossed Africa and was recorded in Kenya, Zanzibar and Tanganyika. About the same time it reached the Cameroons and was found at elevations of over 6,000 ft. The characteristic teleutospore stage was also found in both East and West Africa, thus removing any lingering doubts as to its identity. In 1953, reports of the rust were received from Uganda, Nyasaland, Mozambique, Southern Rhodesia, Mauritius, Reunion and Madagascar. Attacks were not severe in all places, this rust appearing to be best adapted to warm and humid conditions. The assessment of damage from such a disease is, however, difficult without special trials and there has as yet been little time for these to be carried out. One such trial in West Africa in 1952 at Ibadan was done in which plots of maize frequently dusted with sulphur were compared to untreated controls. Sulphur dusting gave only a partial control of the rust, but the difference in yield of grain, nevertheless, amounted to over 40%, and this was on a crop in which the unprotected control plots were not attacked with maximum intensity.

The outlook

With the hope of finding resistant varieties and at the same time ascertaining what maize-growing areas are likely to suffer serious damage if invaded, maize from a number of countries in Asia was procured for test at Ibadan, but none was immune and only one or two have shown slight resistance. The seriousness of this disease was quickly realised in East Africa and as soon as it was discovered there, the East African Agriculture and Forestry Research Organisation began investigations on resistance to it and on a programme of maize breeding. Now that *P. polysora* has crossed the Atlantic and the Continent of

Africa and has reached islands in the Indian Ocean, there seems no reason why it should not eventually reach the mainland of Asia. Eventually genes for resistance to *P. polysora* will no doubt become widespread wherever the rust penetrates, but until then it would seem likely that some period of loss of crop will occur where conditions favour the disease. In Asia maize is an important subsidiary source of food which can ill be spared. So long as a country remains free from this disease, breeding for resistance to it is impossible and, consequently, precautionary measures are impracticable. However, the high probability of rust reaching areas east of Africa would seem to justify the slight risk entailed in introducing *P. polysora*-resistant strains if done with full precautions to guard against accidental introduction of the disease with the seed.

Recommended Common Names for Crop Protection Products

The British Standards Institution has recently issued Part 2 of B.S. 1831 which consists of six common names for pure pest control chemicals well known in agriculture; Part 1 was published in 1952 and further lists will be published from time to time.

Of these six names allethrin and methoxychlor are already accepted as coined common names by the United States Interdepartmental Committee on Pest Control. In both the United Kingdom and the United States the names have been pre-empted as far as possible for common use, by recording them with H.M. Patent Office and the U.S. Patent Office, respectively.

The numbering of the common names is a continuation of that adopted in Part 1.

The Cashew Nut

(*continued from page* 96)

to erosion can provide useful protection and at the same time ensure that it is put to productive use.

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Australian Farming Notes

(*From our correspondent in Australia*)

Wheat problems

Federal authorities consider that Britain is spending an unduly high proportion of dollars on the purchase of wheat from North America while Australia has a large surplus. The Prime Minister, Mr. Menzies, has deplored the current controversy which has made 'the world wheat situation appear weaker than the facts justify.' Competent authorities believe that if Britain had purchased 50,000,000 bushels from Australia—the amount she is believed to have purchased on the dollar market—this country's wheat problems would have been largely solved. As it is, the chairman of the Australian Wheat Board, Sir John Teasdale, anticipates that Australia will have an end-of-year carry-over of about 60,000,000 bushels. This would be enough to supply local needs for another year even if wheat growing ceased completely. In view of the surplus the board has decided to send trade missions to Asia and Africa in an attempt to boost wheat and flour sales. Sir John has also urged immediate action on a two-point plan which should retrieve the position within a year or two. The two points are: A substantial reduction in the acreage under wheat, together with a partial close down in production until supply has again overtaken demand; immediate construction of special storage depots to avoid the disorganisation of transport and storage systems by the temporary shortage of buyers. This, said Sir John, would be the soundest and most economical remedy for the present temporary difficulties.

The Victorian Government, however, refuses to be a party to any crusade for a reduction in the Australian wheat acreage. The Victorian Premier, Mr. Cain, has announced that his Government feels that Australia has a duty to step up primary production and thus make its contribution to feeding the world's millions. There seemed to be quite a number of people who were anxious to provide food, but unfortunately at a price that was beyond the financial resources of those who sadly needed it, Mr. Cain said. His Cabinet would discuss the problem of wheat production, and the Commonwealth suggestion for a ballot with growers on a five-year stabilisation plan instead of a three-year plan.

Sugar experiments

Experimental plantings of sugar cane at the Kimberley Research Station on the Ord River, Western Australia, are continuing to give promising results. The first trial with cane planted in October, 1951, and harvested at 12 months yielded an average of 25 tons per acre over all varieties sown. A second trial sown at the same time and harvested at 18½ months gave higher yields, with one variety producing up to 60 tons per acre. A further trial was started in August 1952, using equipment permitting planting and cultivation under better conditions. Estimates of the yield of the growing crop are high. Special attention is also being given to the sugar content of the crop, which preliminary results indicate is satisfactory.

Linseed cultivation

Despite some initial setbacks, the cultivation of linseed in Western Australia for purposes other than flax production is steadily gaining ground. Shortage of protein stock foods and the general demand for linseed oil by many secondary industries is encouraging many farmers to give attention to this crop. Earlier West Australian attempts to grow linseed for stock foods and oil extraction were disappointing, mainly because of attacks by cut-worm, but effective control of this pest has now been obtained through the use of DDT. A strong demand in Australia for linseed oil is likely to continue for some time. Australia has found it difficult to secure sufficient for domestic needs, hence the attempts now being made to become independent of outside sources. On present prices, and with the yields obtained in Western Australia during the past season, the return from linseed compares more than favourably with wheat.

Wheat crop

Because of bad seasonal conditions in some districts the 1953-54 Australian wheat crop is expected to be about 21.7 million bushels less than that of the previous season. This will represent an 11% decline in the harvest, although the area sown to wheat for grain in 1953-54 is estimated at 10.2m acres, or approximately the same as the area sown in 1952-53. Although a smaller harvest is expected, average yield is expected to be the third highest on record—or about 17 bushels to the acre. Compared with the average production of wheat for the five pre-war years ended 1938-39, the 1953-54 forecast production of 173.5m bushels is more than 12%, or 19.2m bushels higher.

Chemical Weedkillers

A Review of Some Recent Progress

W. G. CASS

THE use of chemical products as fertilisers, herbicides, pesticides, and for animal hygiene is one of the most important developments of modern farming; and although ancient prejudices die hard, they are disappearing with the clearer realisation of the vital part chemical research now plays in shaping agricultural practice, and with the recognition of the vastly greater part it could play in reducing the losses of food and raw material suffered through pests of all kinds, notably from weeds. For impressive figures one often turns to the U.S.A., where losses through weeds have been estimated annually to amount to billions of dollars.

It must, however, be borne in mind that there are other than chemical methods of weed control and it may be well to mention some of these.

Weed control by biological and mechanical methods

For example, Dr. K. Hubert[1] mentions that in fields in Russia planted with Mitschurin varieties of crops the surprising claim is made that weeds do not occur. No details are given but it seems possible that the Russian workers may have evolved varieties of grain crops with which biological or tillage methods of weed control are more than ordinarily effective. Be this as it may, there is however no doubt whatever that tillage and cropping methods can be very powerful weapons for weed control. W. W. Robins[2] has recently claimed that tillage alone or in combination with suitable cropping programmes, is often the most economical method of controlling weeds, and none will maintain, least of all the manufacturers of herbicides, that chemical applications can be an effective substitute for good farming.

The same authority also emphasises the importance of crop rotations in this connection and suggests that much more attention could with advantage be directed to this aspect in the war against weeds than has hitherto been the case. The value of rotations in weed control has also recently been extensively studied on the continent of Europe and a long report on weed control and crop rotation has appeared in the Hungarian agricultural journal, *Agronomica*.

The use of chemical weedkillers is extending rapidly; the increasing importance attached to the matter in Britain is evidenced by the holding of the first National Weed Control Conference in November last. In the following pages some features of recent developments are reviewed.

Examples could be multiplied but the foregoing suffices to show the importance of other than chemical methods in weed control: it does not, however, in any way weaken the case for the use of chemical herbicides, but it emphasises the importance of good husbandry methods, and the danger of placing undue reliance on chemical methods alone, and of discounting extravagant claims on their behalf.

The importance of chemical methods

There is unfortunately still a great deal of prejudice and superstition operating against the use of chemical weed-killers and artificial fertilisers on the farm, and it is obvious that nothing should be done or said that can encourage or reinforce such mistaken beliefs. It is too often the case that the older members of the farming community express doubts whether modern methods are giving better yields than those formerly obtained, and such expressions of opinion, when voiced by men of life-long experience, undoubtedly carry weight, unsupported though they may be by any reliable factual data. Much remains to be done to bring home the true facts to farmers by education and demonstration. In Britain, much is being done by the National Agricultural Advisory Service and by demonstrations by firms manufacturing and supplying weed-killers. On the continent of Europe progress is also being made. In Germany, the number of plot demonstrations is increasing. Thus Hubert (*loc. cit.*) records that in Sachsen Anhalt the number of demonstrations carried out increased from 100 in 1950 to 159 in 1952. He gives no details of the tests but in regard to the kinds and amounts of weed-killers used in Germany he records that the non-hormone type mainly copper

Treated marshland which has been sprayed with manurial 'Phenoxylene'

and dinitro cresol derivatives are the most popular, produced and marketed under such names as Hedolit, Raphanit, Raphanox, and Selenon. Of the hormone type mention is made of Leuna UT 10, Spritz Hormin (a spray fluid) and Staube Hormin (a dust). The precise chemical formula for these preparations is not given.

Recent developments in the U.S.A.

A vast amount of literature on the subject of weed control continues to be published in the United States. The subject figured prominently at the meeting in Los Angeles of the Agricultural Chemical Section of the American Chemical Society in March 1953; in some papers a historical retrospect was given, which for the hormones is of necessity very short since the first successes with this type only occurred about 1942, although a certain amount of selectivity had been shown by some pre-war products, *e.g.* sodium o dinitro cresylate, o dinitro sec buty phenol and ammonium sulphamate.

In the U.S.A. the total consumption of weed-killers in 1951 was estimated to be 122 million lb., of which phenoxy acetic derivatives accounted for 39.7 million, trichlor acetic acid for 7.5 million, and the inorganic compounds sodium chlorate for 35 million and sodium arsenite for 7.5 million. It is noteworthy that despite the increase in the newer organic herbicides the older inorganic compounds have so far well maintained their places. The production of sodium chlorate in 1953 is estimated to have exceeded 53 million lb. while the new inorganic weed-killer, ammonium sulphamate, has risen to several million lb. of recent years.

It is, however, expected that the newer organic weed-killers will in the near future take the major portion of the sales, notably 2-4 D, TCA and 245 T, while a number of new preparations are said to be showing great promise. The production of the organic weedicides is in the hands of four or five leading firms, though a number of others prepare esters and salts from the acids made by the largest firms and market their own formulations.

Part of 70 acres of untreated black sand marshes, near Biddington, Norfolk. The chief weeds are rayworth, thistle, buttercups and meadowseet

Promising new compounds

Among the newer compounds are:

SES (sodium 2, 4-dichloro-phenoxy ethyl sulphate) by Carbide and Carbon Chemical Corp.

MCPA (2-methyl-4-chlorophenoxy acetic acid), Dow Chemical Co. and Monsanto Chemicals Co.

IPC (iso-propyl-N-phenyl carbamate), US Industrial Chemicals Co.

CIPC (iso-propyl-N-3 chlorophenyl-carbamate), Monsanto Chemicals Co., etc.

CMU (3-p-chlorophenyl-1, 1-dimethyl urea).

A relatively new idea in weed control is that known as ' pre-emergence,' described in detail by Robbins *et al.*, and in numerous recent articles. It merely means treating the seed-beds after sowing and before emergence of any appreciable growth of weeds. Stove oil and diesel oil were used in early work, and subsequently the newer herbicides. But water-soluble toxicants must not be used.

Some other work in the U.S.A. can only be briefly noted. It includes the use of carbamate derivatives as herbicides for cotton, soya beans, etc.

Specially difficult conditions have often to be faced in connection with weeds belonging to the family gramineae. What have been termed grass herbicides are therefore of special interest. These have been studied in the U.S.A., and also in Britain; in the U.S.A. a recent paper by R. M. Blouch may be mentioned which summarises some of the recent work.[2] He points out that the metabolism of the

Part of the same area of black sand marshes after having been treated by ' Weedmaster ' with ' Phordene '

A trial laid down by the N.A.A.S. at Hailsham demonstrating the control of rushes in pasture with 'Agroxone'

grasses differs from that of dicotyledonous plants, thus 2-4 D exerts only a fraction of its normal growth-regulating effect, and the hormone type herbicides are unsatisfactory. Moreover, the regions of greatest meristematic activity are at the base of the plant and thus are largely protected, while the leaves are narrow and difficult to wet, even with a sticker. The first successful results were obtained in England by Blackman and his colleagues, using the N phenyl carbamates, notably the isopropyl member, IPC. Its action was found to be non-systemic and consisted of mitotic poisoning in the root tips, somewhat similar to the effects of colchicine.

In the U.S.A. good results have followed the use of salts of trichlor acetic acid for the control of grasses, notably the sodium and ammonium salts. Another graminicide is MH or maleic hydrazide, while work with substituted derivatives of IPC has been extensively prosecuted, notably with chloro IPC, at the Colorado Agricultural College.

Work in Britain

It can be claimed that Great Britain has all along been in the van of progress in the matter of weed control, particularly in grassland improvement, reclamation of marshland and other directions. In November last there was held the first National Weed Control Conference, at which a large number of papers were presented covering almost all aspects of the subject in its British application. No doubt spraying for weed control has obtained considerable extension in Britain but, as E. T. Holmes[4] pointed out at the conference in question, the bulk of the spraying so far carried out has been done by or for the more progressive farmers, the fields of farmers who have not sprayed are, on the whole, more weedy than those of the progressive farmers who have sprayed, and in cereal production, if spraying for weed eradication could be increased to cover another million acres, it would increase yields very substantially.

The statement already quoted, by an American authority, that on arable land good farming in respect of tillage and crop rotation is usually the most economical and the most effective method of weed control may need some qualification and amplification in relation to English experience; there seems to be evidence in fact that the greatest increases may be obtained by a combination of the use of herbicides with tillage operations at the appropriate times. Chemical treatment for the eradication of weeds is beneficial to most arable crops and its extension to the control of weeds in horticultural crops is now being investigated at East Malling and elsewhere; F. R. Tubbs,[7] director of East Malling experiment station, has recorded that these investigations have included the use of sodium chlorate and MCPA for the control of weeds under apples, the use of MCPA and 2-4 D for the control of bindweed under blackcurrants, and the use of a new derivative, SES (sodium dichlorophenoxyethyl sulphate).

The ultimate aim may be the elimination of all weeds as envisaged by Dr. W. E. Ripper, but despite progress in the past few years that consummation is still remote, while weeds vary greatly in the harm they do and some may even be mildly beneficial, *e.g.* when grazed by livestock; the problem therefore seems to be the discovery of a selective weed-killer which will in some measure discriminate between harmful and beneficial weeds.

Resistant weeds

A more serious problem is to find a combination of different weed-killers which will prevent the emergence of resistant species of weeds able to withstand the effects of herbicides.

Excessive dependence on one weed-killer may have that effect, and effective weed-control may necessarily involve ringing the changes on different forms of control at different seasons. As Dr. Ripper has pointed out, in the U.S.A. for weed control in corn crops reliance has been placed on hormone weed-killers and resistant forms of creeping thistle have already appeared. In England the probability of the segregation of resistant mutants was early realised, and leading authorities on weed control initiated the 'rotation' of various types of weed-killer, with considerable success.

In Britain derivatives of MCPA (methyl chloro phenoxy acetic acid) are preferred to those of 2-4 D, which predominate in popular favour in the U.S.A. In Britain 2-4 D, when used on pastures, has been found to reduce the yields of herbage.

MCPA has been found particularly effective in controlling weeds, both in cornland and grassland and the cost is low in comparison with increases gained. In 1951 Halliday and Templeman,[5] in a series of experiments, established that autumn applications of MCPA in pastures in conjunction with correct fertiliser application increased the yield of edible herbage by 5.2 cwt. per acre, while Zeller Pfeifer and Gregory[6] have recently shown that if any reductions at all follow the use of MCPA on pastures they are economically insignificant and can be avoided altogether by applications of fertiliser.

Grassland in Britain

E. B. Scragg,[8] at the North of Scotland College of Agriculture reports that in pastures in North Scotland most of the weeds encountered are perennials and can be satisfactorily dealt with by selective herbicides of the hormone type, although of even greater importance is good management, including ploughing and reseeding where necessary, drainage, liming and fertilisation.

The vast possibilities of grassland improvement in Britain have long been realised. In Britain there are four types

Control of buttercup in grassland with 'Agroxone,' with the untreated strip between the two treated

of grassland: (1) mountain and heath pastures, (2) downland pastures, (3) permanent lowland pastures and (4) leys in arable rotations. In efforts to improve the first of these herbicides probably do not play a leading role and improvement is mainly to be sought in good management, including properly regulated grazing, periodic cutting or burning, with applications of phosphatic fertilisers and the introduction of white clovers. On permanent pastures, and to a less extent with leys, the possibilities are much more impressive, especially when hay yields are low. The ratio of weeds to useful grasses is sometimes surprisingly high; in one case it was reported to be 4.9 weeds to 1.9 of useful grass. Obviously, in these conditions, the elimination of weeds must prove highly beneficial.

The rates of application of MCPA for effective control of weeds are relatively very small. The best results have, on the whole, followed applications giving only 2 lb. per acre. Larger applications, using up to 4 lb. per acre, have given less satisfactory results.

Fertiliser and herbicide combinations

The use of selective weed-killers in conjunction with fertilisers has become established practice for some time past, both on pastures and also for the improvement and renovation of lawns. Many grasses respond well to applications of phosphatic fertilisers, but if these are applied to the soil a considerable proportion of the phosphoric acid may become fixed and unavailable to the plant. It has been found, however, that phosphates can be absorbed through the leaves and fertilisers may be more effective and rapid in their action if they are applied in this way. It has been found that a judicious application of MCPA mixed with some form of phosphatic fertiliser has given excellent results. Other soluble fertilisers, such as sulphate of ammonia, can also be used, and, indeed, the introduction of herbicidal fertilisers has opened up a wide field for further research.

The mode of applying such mixtures and, indeed, of herbicides generally has also opened up a considerable field for research and developments in agricultural engineering in the design of dusting and spraying machinery, both hand and power operated, including both application from the surface of the land and also from the air by means of aeroplanes. Aerial application has involved also difficult problems in regard to the effects of spray drift and in some countries has even led to legislation. Thus, in certain states in the U.S.A., certain forms of aerial distribution have been prohibited by law.

Conclusion

The foregoing gives some idea of some of the more recent developments in weed control, but to quote once more Dr. E. Holmes,[4] speaking at the recent Weed Control Conference, 'We have still only gone a little way in solving the problem of eliminating weeds from our farm crops. On the other side of the Atlantic, Dr. Stahler, a well-known authority on weeds in the United States, has said that even with the advances agricultural chemistry has made in helping to control weeds the annual loss to farmers in the U.S. is still estimated at $36 billion (£11,000,000,000). The immediate problem for research chemists and botanists is to find new chemicals with different specificities to control the serious weeds not susceptible to current products.'

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Photos: Pp. 99 and 100, Pest Control Ltd.; pp. 101 and 102, Plant Protection Ltd.

Plant Protection Chairman

Mr. E. M. Fraser, C.B.E., has been appointed Chairman of Plant Protection Ltd. in succession to Mr. T. Ainslie Robertson, who is to retire on March 31, 1954. Mr. Fraser will continue as sales controller of Imperial Chemical Industries Ltd., a position he has held since 1945. Mr. Robertson, who is a director of Cooper, McDougall and Robertson Ltd. has been Chairman of Plant Protection since 1943.

Mr. Fraser joined Brunner, Mond and Co. Ltd. in 1919. On the formation of I.C.I. in 1926, he became assistant to the commercial director. Then, after service as commercial director of I.C.I.'s Dyestuffs Division and later of the Billingham Division, he was, in 1934, appointed manager of the south-eastern sales division, an office he held until the second World War.

At the outbreak of the war, Mr. Fraser was appointed Director of Investigation and Statistics at the War Office. Subsequently becoming in 1943, director-general of aircraft production. He received the C.B.E. for his war-time services; he returned to I.C.I. in 1945, and in October of that year was appointed sales controller. He has been a director of Plant Protection Ltd. since 1946.

Shell Agricultural Chemicals Division

Shell Chemical Corporation has changed the name of its Julius Hyman and Co. Division to the Agricultural Chemicals Division. The division, with headquarters in Denver, Colorado, will continue to market aldrin, dieldrin, endrin, DD and other insecticides and agricultural chemicals. This change affects only the sales organisation; the plant in Denver continues to be operated by Julius Hyman and Co.

Dalapon

A New Plant Growth Regulating Substance Effective on Grasses

As a sequel to the foregoing article the following account of a new herbicide recently announced by the Dow Chemical Company of Midland, Michigan, U.S.A., is of interest. It is claimed that the compound in question is of especial value inasmuch as it is effective against grasses. The account has been abstracted from literature supplied by the Dow Chemical Company. In May 1953 the Dow Chemical Company announced the discovery of a new grass controlling agent and summarised the results so far obtained with it. During the summer of 1953 samples of the product were supplied to various State and Federal experiment stations in the U.S.A. The results of further trials and information relative to the properties of the new product have recently been published in the form of a new bulletin by the Dow Chemical Company.

To the new product the name of 'Dalapon' has been given. Chemically it is 2,2, dichloro propionic acid and is formulated in the form of sodium salt. Many other derivatives of the acid are stated to have been formulated and tried but none was found to have any greater activity than the sodium salt.

The sodium salt is said to be a free-flowing white to light brownish powder readily soluble in water and alcohol but not in most of the common solvents. It is low in oral toxicity to mammals and experience has shown that it is pleasant and easy to handle and use.

Results are quoted of trials with the product in some 17 different states in the U.S.A. as well as in a number of provinces of Canada, against grasses which function as weeds in a large number of crops with satisfactory results. The grasses included Johnson grass, Crab grass and other annual grasses growing in cotton, water grass in sugar beet and Bermuda grass. Certain gramineus and broad-leaved crops are however liable to be damaged by Dalapon. The dosages used in trials varied from 8 up to 60 lb. of the product per acre.

General conclusions

The general conclusions drawn from the trials to date are summarised by the manufacturers in the following terms:

It is evident from experimental results reported that Dalapon (sodium salt) holds considerable promise as an herbicide for the control of a number of grasses and certain other plants. It is equally evident that the compound exhibits a number of limitations which must be considered in planning future experiments.

Certain facts concerning the growth habit of grasses must be kept in mind in interpreting results with Dalapon (sodium salt). Grass seedling emergence may follow relatively soon after application if heavy rain occurs. Under such conditions repeated applications at intervals of several weeks using low dosages to give practical control may be more effective than a single higher dosage.

Some rhizome buds may recover from perennial grasses even at relatively high dosages. The vigour of grass is such that even 5 or 10% rhizome bud recovery may result in a considerable stand of grass after a favourable period for spread; *i.e.* cool moist weather for Northern grasses and warm moist weather for Johnson grass and Bermuda grass. In this connection repeated moderate dosages to give practical control should be considered.

Much has yet to be learned about the effect of environment and condition of the plant on the efficacy of Dalapon action. The following observations may suggest variables that should be studied further:

1. The sensitivity of grasses to Dalapon appears to decrease with increasing age of the plant.
2. In some instances Dalapon has appeared to be less effective when applied to grass growing under dry soil conditions. Conversely it has often proved most effective when applied to actively growing succulent grass.
3. Northern or cool weather grasses, such as blue-grass and quack grass have been effectively controlled by early spring applications when the weather is still cool, although the action may be quite slow.
4. Early application to warm season species such as Bermuda grass and Johnson grass (before much new foliage has developed) has not proven as effective as application made after considerable growth has occurred.
5. Seed stalk development has been arrested or prevented by application in the early boot stage or before. The stalks may continue to elongate if application is delayed.
6. In general, best results have been achieved with sprays that adequately wet grass or reed foliage.

It is not possible at present to classify crops according to their relative tolerance to Dalapon. It is evident from work with corn that basally directed sprays on older plants may be tolerated by species which would not tolerate a foliage application. Alfalfa, beets and possibly potatoes and flax may be adequately tolerant to permit the use of overall sprays. Cotton shows some tolerance and certainly basal spraying shows promise. Soya beans and snap beans are among the more sensitive broadleaf crops. Certain forage legumes such as Ladino and red clover seem to be rather sensitive.

It may be concluded that Dalapon (sodium salt) is a promising new herbicide. Certainly extensive field and laboratory investigations should be undertaken in 1954 so that its rightful place in agriculture may be determined prior to its introduction for farm use.

Krilium Price Reduction

Monsanto (Soil Conditioners) Ltd. has announced a reduction in the retail price of the 1 lb. container of Krilium Merloam formulation from 10s. 6d. to 7s. 6d. The company has also stated that early in 1954 Krilium in the Merloam formulation will be available in a new 2 oz. package particularly suitable for pot plant and window box cultivation. The new package, which will retail at 2s. will also permit users to carry out small scale introductory trials with Krilium at reasonable cost.

One 2 oz. package is sufficient to treat 34 4 in. pots of soil or 2 sq. ft. of soil to a depth of 3 in. Used in row treatment, 2 oz. is sufficient to treat a 4 ft. row 3 in. wide to a depth of 3 in.

African Cotton Tour

Mr. James Littlewood, Chairman of the Empire Cotton Growing Corp., left Britain on January 20, on a three months trip to Africa, where he will visit the Sudan, Aden, Uganda, Kenya, Tanganyika, Nyasaland, Southern Rhodesia and South Africa.

In addition to visiting experiment stations on which members of the corporation's staff are working, he will also hold discussions with Government officials on the subjects of increased cotton production in Africa and the marketing of such cotton in the United Kingdom, two topics which are of particular importance to Lancashire and to the Empire at the present time.

Fires in Crops

N. C. STROTHER SMITH

Assistant Director, Fire Protection Association

In many crops fire can be a considerable source of loss and fire hazards are a risk that must be reckoned with and guarded against. The risk varies with the crop, it being greatest in tall growing crops and timber and in crops which produce a large amount of straw or trash. Below the subject of fire hazards in crops is discussed and the precautions which can be taken to minimise them outlined.

MANY crops, which present a serious fire hazard when harvested and processed ready for manufacture, present little or no hazard when growing. However, there are some in which outbreaks of fire may become very serious and difficult to control. Chief among them is timber, but others, for example, sugar cane and some cereal crops, are subject to rapid spread of fire when they reach maturity, particularly in hot, dry weather. Many crops are more liable to ignition by fire spread from some other readily combustible material than by a small source of fire, but once a fire has started, spread may be extremely rapid and almost impossible to check by normal extinguishing methods. Dense dry undergrowth is very easily ignited by a small spark and will quickly spread fire. Fields of stubble are also readily ignited because of the abundance of loose dry material scattered during harvesting and, under favourable conditions, a fire may travel much faster than a man can run. A fire in dried harvested plants may also be responsible for spreading fire to those still standing.

Causes of fires in plantations

Smoking and the careless burning of rubbish are probably the most common causes of fires in crops but camp fires, sparks from railway locomotives, the engine exhausts of machinery, domestic fires, oil lamps and stoves, electric equipment and other normal domestic or industrial fire hazards can be responsible for outbreaks of fire which may ultimately spread to and destroy a plantation. Fires have also been started by lightning, the burning of grasslands to promote growth, broken electric cables, broken bottles and fragments of glass and phosphorus baits for the destruction of rabbits. Good management, not only of the plantation itself but of the whole estate, buildings, equipment and employees is therefore essential to prevent fire.

Not only may the burning of a field of stubble spread fire to other crops but a spark from an unswept chimney of a domestic fire or the burning of rubbish may start a fire in a rickyard which, in turn, may spread to a ripe standing crop. On a well-ordered estate if a fire breaks out, not only is it less likely to spread beyond control, but it is more easily extinguished.

Fire control

Fighting farm or plantation fires is a very difficult operation, particularly where large areas are at risk; water supplies are usually meagre and the distance from a fire station is often such that the arrival of fire-fighters at the seat of a fire may be delayed until the fire has obtained a firm hold. If the origin of the fire is at some distance from the nearest habitation it may be hours before it is discovered and reported and the roads may be far from adequate to carry heavy fire-fighting appliances.

The control of fire in short standing crops may be possible in the absence of adequate water supplies by beating the fire with brooms, but in a dry season, when the speed of travel of the fire is great, beating the flames would be useless and dangerous, unless a very large number of people were employed.

Fires in tall crops and timber

In tall growing crops and timber, beating would be impossible, unless the fire had been confined to the undergrowth. Timber plantation fires are the most difficult of all to control because, once the flames have reached the tree tops, they are impossible to reach and may travel at great speed while sparks may be carried by the wind to start fresh fires some distance away. Firebreaks hastily constructed by digging or chopping down undergrowth and beating the flames with brooms may be possible means of extinguishing timber fires if they are discovered in their early stages, but once a fire has gained a hold these methods are

Fire-fighting in a French forest. The undergrowth is on fire but the 'tinsel' effect on the trees is probably reflected light

little more than useless. A fire in a timber plantation once it has gained a hold will defy even the largest and best body of firemen to extinguish it.

The amount of water necessary to extinguish the flames and cool the timber so as to ensure no further outbreaks could never be collected to cover the areas likely to be involved. To make firebreaks by cutting down the timber in the path of the fire would require more time than the fire would allow and every tree would have to be dressed or dragged away to clear the firebreak. Controlled counter fires lit in the path of the main fire are of doubtful value and may have serious and embarrassing repercussions.

Firebreaks

The only practical way of checking fire spread and thereby extinguishing fires in large plantations is by the use of planned and properly prepared firebreaks. Ideally a firebreak should consist of a belt of vacant land completely cleared of all grass, weeds or undergrowth, wide enough to prevent fire jumping from one side to the other even with the help of a wind. Economically such a firebreak may be impracticable, particularly in tall growing timber where it may have to be as wide as 100 yards. The width of firebreaks and the areas which they isolate can only be determined in relation to particular types of crop. Factors which govern the size of breaks are the height of the crop, its likelihood of shedding burning particles in the wind and its ease of ignition; firebreaks across the line of the prevailing wind should be wider than others. Factors governing the areas to be isolated are the value and the inflammability of the crop concerned.

In short crops, such as wheat and those with fleshy stems, narrow firebreaks may be sufficient, partly because such crops are less easily ignited and control of fire spread is therefore easier, but also because a fire in them is easier to observe and warning may be given before a serious outbreak has developed. In any event even the narrowest firebreak prepared in advance is of value since it gives an opportunity to fire-fighters to surround the fire.

Intercropping

As an alternative to firebreaks specially cleared and constructed, intercropping with less hazardous crops between the more hazardous is of value. For instance, where mixed crops are grown, an area may be divided up and sown with crops maturing at different times, so that at any given time a limited area of dry easily-ignited plants is separated from a similar area by less mature plants or by those with fleshy stems not readily ignited. It may be possible to create firebreaks in a timber plantation by intercropping with short-standing crops; in this way otherwise unproductive lands can often be put to good use. Where mixed timber is grown the same principles of intercropping may be used to advantage. Evergreen trees, particularly conifers, are the most easily ignited and fire spread in them is greatest, so that if they can be separated by wide belts of hardwood deciduous trees some check to fire spread may be obtained, though, of course, the deciduous trees may suffer serious damage. Belts of trees of different heights will also help to control the spread of fire. This may be arranged in plantations of a single type of tree by careful planning in planting. The greatest hazard to timber plantations is from undergrowth and if this can be cut down and cleared frequently a great deal will have been done to prevent outbreaks and control the risk of fire spread.

A forest fire in France

A fire on a sugar cane plantation

Common land

Common land bordering on farm lands and plantations is a further source of danger, for the farmer or planter has no control over it and a fire starting on common land may endanger the plantation. Wide firebreaks should be maintained around all the plantation boundaries, either planted with crops not easily ignited or left entirely clear of all vegetation. Bush, scrub and heathland spread fire very rapidly when dry and once a fire starts there will be no time to construct firebreaks.

Provision of facilities for fire-fighting

The provision of adequate facilities for fire-fighting is vital to the control of fires immediately they are discovered. In places remote from towns as much water as possible should be made available, either from natural sources such as lakes and rivers or by the erection of tanks or

water towers. On large plantations water sources should be provided at as many points as possible. Tanks should be designed to take the maximum advantage from rainfall but arrangements should also be made for filling them by artificial means if possible, and hard standing ground for pumps should be provided. Brooms for beating out small fires should also be provided at many places throughout the plantation.

Good roads capable of carrying fire-fighting appliances are essential and for this purpose advantage should be taken of artificial firebreaks but they should have at least a 12-ft. width of hard surface which may serve as a road.

Warnings of fire outbreaks

It is advisable to provide facilities for giving immediate warning of fire. As well as arranging telephonic communication with the nearest fire brigade, lookouts should be constructed to command a view over the whole plantations. In periods of drought, when the fire hazard is greatest, it would be a wise precaution to man the lookouts night and day. At other periods it should be sufficient to man them during working hours and for one hour afterwards only. Adequate facilities for communication between the lookouts and some central point near a telephone are practically essential. On farms and plantations remote from fire brigade stations it would be a worth while expenditure to provide a mobile water pump and hose and to have a number of employees trained in the use of the equipment.

Fires in farm buildings and processing plant

Many crops have to undergo some processing before they leave the plantation which involves the use of plant, machinery and buildings. Whereas the task of fire-fighting is much simpler when the product is contained in a building the fire hazard of many crops is appreciably increased after it has been harvested and dried. Some crops, particularly those of a fibrous nature are easily ignited when dry and, yet, if they are stored before they are properly dried they are liable to undergo spontaneous heating and possible ignition. Care has to be taken therefore to exclude all possible sources of ignition from the storage sheds and to maintain careful watch to ensure that no undue spontaneous heating occurs. Furnaces and other heating equipment should be installed in compartments separated from other buildings by walls and floors of fire-resisting construction and entered only from the outside. Care

Part of a forest fire which swept plantations in Aberdeenshire

should also be taken to ensure that sparks from the furnaces cannot come into contact with combustible material, while petrol and oil-driven vehicles and machinery should not be allowed inside the storage sheds. Precautions are also necessary to guard against the normal domestic fire hazards in all administrative and domestic buildings on the estate. Fires of all types are naturally a major hazard; *e.g.* grate fires, gas, electric and oil fires, stoves and furnaces and the burning of rubbish. Attention should be given to guards for the fires, the frequent sweeping of flues and the safe disposal of ashes.

Special precautions for processing machinery

Special precautions are necessary with certain processing machinery, such as artificial drying plants, mills for grinding cereal crops and saw mills for timber. Care is necessary to ensure that sparks cannot be carried to the material being dried, particularly if solid fuel heaters are used, and that an even safe temperature is maintained in the material. The risk in grinding equipment is from foreign bodies which may cause sparks should they pass the grinding rollers. In saw mills the dust is the main hazard. It can be ignited by a small source of ignition and has a great capacity for smouldering which may not always be observed. Saw mill driving machinery is best separated from the saw, so that sparks from the engine cannot fall on to dust or, in the case of electric motors, a dust-tight enclosure should be used.

Fire extinguishers

Portable extinguishers should be provided in every building and, if possible, hose reels should be installed and connected to a liberal supply of water with sufficient pressure and in sufficient number to cover all the buildings. The extinguishers should be of the soda/acid or water (gas pressure) type but foam extinguishers should also be provided to protect petrol or oil-driven machinery.

Photos: P. 104, International News Photos; p. 105, top, Aerofilms Ltd.; p. 105, below, Tate and Lyle Ltd.; p. 106, Newcastle Journal.

Committee on Soil Conditioners

For several years consumers have been perplexed by conflicting statements as to the capabilities and value of soil conditioners. A committee on soil conditioners was authorised in 1952 by the board of directors of the American Society for Testing Materials. An organisational group, which included representatives from the Association of Official Agricultural Chemists, the National Agricultural Chemists' Association, the Soil Science Society of America, and the Department of Agriculture, was formed to initiate the establishing of this committee. This group recommended that the Association of Official Agricultural Chemists and the American Society for Testing Materials jointly sponsor the committee on soil conditioners.

The organisational meeting of the joint committee has been held at Ohio State University, Columbus, Ohio. The purpose of this joint enterprise, staffed by consumers, manufacturers, and experimental research organisations alike, is to inform the individual consumer as to the use and the performance of the various soil conditioners available.

Pakistan Fertiliser Acquisition

An agreement for the acquisition of 50,000 tons of fertiliser and its distribution in Pakistan has been signed between the Government of Pakistan and the Government of the United States of America under the T.C.A. programme. The project is likely to cost the Government of Pakistan Rs. 3,230,000, while the Government of the United States will incur an expenditure of $3,100,000 for the supply of the fertiliser.

Irrigation in Algeria

D. ANLEY

In Algeria, as in other North African territories, water is the predominant consideration governing agricultural development. Below some of the aspects of irrigation as carried out in this region are described and discussed.

COMPETENT planning, continuous searching for fresh supplies and fair distribution, are some of the main functions of the Service de la Colonisation et de l'Hydraulique in Algeria. It must also constantly guard its resources against any natural event which may occur in this varied country. Algeria is composed mostly of rich alluvial plains. There is a maximum amount of sunshine but there must be water to render it fertile.

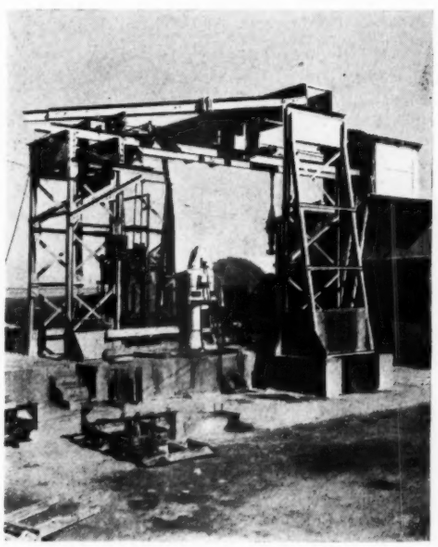
The problem of irrigation was one of the first to be tackled by the early French colonists. A beginning was made by exploiting the rivers and streams but, unfortunately, the supply in these was very irregular, and cultivation of profitable summer crops could not be undertaken with any degree of certainty. In order to provide for this seasonal shortage, large reservoirs were constructed to store water during the winter months and advancing through various stages of progress, a modern construction programme has now been put into operation whereby growers and farmers will be assured of a regular water supply for planting vineyards, orange groves and fruit trees.

Difficulties

Two difficulties have been experienced in constructing these dams. The first and most important is that presented by the soil. In one or two instances only has it been possible to place them on solid rock and it has usually been necessary to erect them on clay, sandstone, and a diversity of permeable soils.

The second difficulty is the irregularity of the river flow, and the danger of flooding during humid seasons. Great attention must be given to the making of elaborate and solid spillways to carry off excess water and lessen the danger of soil erosion. Strengthening the ground by cement injections has frequently to be undertaken during construction work, thus adding considerably to the cost of the scheme.

There have been one or two instances of part of the dams being carried away by floods. These have been repaired and strengthened by high tensile steel wires drawn vertically through the masonry and anchored to a solid foundation. Groups of these are placed at regular intervals along the dam, their ends terminating in a solid concrete block. This operation has proved very successful.



A small pumping station

Distribution of irrigation water

After storage the problem of distributing irrigation water arises. Where the land is close to a reservoir the method is fairly simple, water is carried through pipes and the grower draws from these direct. At some stations water is pumped electrically from the river bed to a reservoir, and thence flows through pipes and open channels to the cultivation. The process, however, becomes more complex when long distances have to be covered. Use is then made of large open canals, divided and sub-divided into smaller channels until they reach the individual grower.

This has caused a new industry of pre-stressed prefabricated pipes and armoured slabs to spring up in Algeria. Large French firms have established factories in the country for the manufacture of these products. The firm of Campenon Bernard use the 'Fressinet' method for which they hold the sole concession in North Africa. This system enables the pipes to be used directly they come from the mould, the whole process of fabrication taking about three hours. They are pre-stressed lengthways and crosswise, the finished product being hardened off by a steam process. Quite by accident it was found that these pipes were self-sealing. This first became evident when water hammer took place in the pre-stressed concrete pressure pipe of the

Oued Fodda Dam. One of the few to be constructed on solid rock foundations

(*Left*) **Irrigation canal, showing constant up-stream level gate** (*Right*) **A view of the spillway of Ghrib Dam, showing elaborate and costly construction**

Pre-stressed concrete irrigation canals

power station of Pontéba. Fissures appeared and water escaped in veritable geysers. When the water hammer ceased, the fissures closed and everything became quite normal. Being pre-stressed lengthways also enables them to be placed across gaps up to about 50 ft. in width, without using supports other than those of the firm ground at either side. Canals and supports are cast to a simple pattern which allow them to be easily assembled on a site.

Flow regulation

An extremely careful study has been made of regulation of flow, in order to meet supply and demand.

The firm of ' Neyrpic,' after carrying out extensive experiments in their laboratories at Grenoble (France), have patented an automatic sluice which ensures constant up-stream level. This is simple in design, and is used with other devices throughout the irrigation system in Algeria to regulate levels in canals and distributories. Manual distributors, divided into sections, and provided with small sluices of different sizes which can be raised to pass the required amount of water per second, are also used. The whole irrigation network is kept under constant observation, to ensure that the water is kept at a sufficient height above the ground to be irrigated. There must be no overflow, and the canals are kept as full as possible in order to protect them from the sun.

Salinity

Salinity is frequently found throughout Algeria, and manifests itself in the form of salt lakes and marshes. The cause of this is still not clear and it is not known whether it is due to sea penetration or to saline layers in the soil or underlying rocks.

Administration

Administration of irrigation has been decentralised as much as possible, and divided into sub-divisions : each is in charge of an engineer who maintains close contact with the users, to understand their requirements and to give them guidance and counsel without losing sight of the general economic plan of the undertaking.

All cultivators requiring irrigation make known their needs to the sub-division for their area. The accounting section divides operations into periods lasting for a week, a fortnight or a month, according to the season. Each grower receives a card which informs him of his watering hours, and the volume of water which he may use. A strict account is kept, and the ledgers balanced at the end of the year.

The field of activity of a sub division is extremely large, and includes such things as the maintenance and development of the distributory network, the laying of new pipes and canals and also electrical matters for electricity is used in connection with pumping operations, also for operating spillways and sluice gates. Scientific research is carried out on a large scale, and it is the duty of sub-divisions to pass the knowledge gained to the growers.

Conclusion

The foregoing serves to give some indication of the extent and importance of irrigation in Algeria. The irrigation system comprises many hundreds of miles of canals and distributories which ramify like arteries through the cultivated region, and its maintenance and extension is a primary responsibility of the French North African Government. On the efficient functioning of the irrigation service the prosperity of the country is largely dependent.

The Combining and Storage of High Moisture Wheat

VIRGIL MARVIN *

The combine harvesting and storage of grain with a high moisture content is a problem which frequently arises, especially in localities where humidities are high. The following is an account of some recent experiments on this matter in Ohio, U.S.A.

THE problem of conditioning high-moisture wheat for farm storage involves the solution of two problems:

1. The problem of determining at what per cent. moisture wheat can be satisfactorily combined.
2. The problem of mechanically ventilating the wheat in storage bins.

The first problem

Wheat at a moisture content of 14% is considered safe for short time storage. Therefore, wheat is usually combined at that figure, or lower, and combine efficiency tests have been made at 14% moisture or lower. In order to take the small grain ventilation story to the farmer, however, it was necessary to have facts available on combining high moisture grain. To obtain the answer to this problem we solicited the aid of the Dearborn Motor Corp., manufacturers of farm machinery. They were very interested in the project and responded by furnishing the harvesting equipment and combine engineers to make the harvesting test. The plan was to harvest and make all tests, including mechanical ventilation, at 19% moisture. The work was performed on a farm at Grand Rapids, Ohio.

The tests

On July 1, 1952 a small quantity of wheat was successfully combined at 34.6% moisture. However, the wheat was immature and of too high moisture for drying by mechanical ventilation. The important point was that the combine did a satisfactory job of threshing out the grain.

On the afternoon of July 4, 1952 a small quantity was combined at 23.6% moisture. At this stage the combining was highly successful. It was the opinion of those on the project that the grain would be between 18% and 19% moisture on Monday, July 7, 1952. At this point nature caused our plans to go astray. Due to exceptionally good drying conditions over the July 4th weekend, the moisture content of the wheat in the field we were observing dropped to 13.8%.

The combining operation was then transferred to a field of 16% moisture wheat. In this test 1/60 of an acre plot was used. The finished grain from the test plot was collected in a sack as it was being discharged into the combine bin. A canvas was carried behind the combine to collect the cylinder, rack, and shoe losses. The grain discharged into the sack from the plot weighed 39.5 lb. The grain collected in the canvas representing the cylinder, rack, and shoe losses, weighed 1 oz. The grain on the ground representing cutter bar loss, was 0.75 oz. The total loss on the test plot was 1.75 oz. of grain. In this test the combining efficiency was 99.73%. The results are summarised below:

TABLE 1

Finished grain	39.5 lb.
Rack, cylinder, and shoe loss	1 oz.
Cutter bar loss	0.75 oz..
Total weight of grain	39 lb. 9¾ oz.
Total losses	1.75 oz.
Per cent. of losses	0.27%
Combining efficiency percentage	99.73%

On July 8, combining operations were resumed in the field that tested 13.8% moisture content on July 7, 1952. However, a shower in the afternoon of July 8, 1952, caused the combining to stop for the day. Combining was resumed on July 9, about 8 a.m., but the moisture content of the grain had increased from 13.8% to 15.7%. The important point here is that combining was started at 8 a.m., after a shower the previous afternoon. Ordinarily, the operation would not have started until the grain moisture had been reduced to 14% or lower. This operation was possible because the storage bins are equipped for mechanical ventilation.

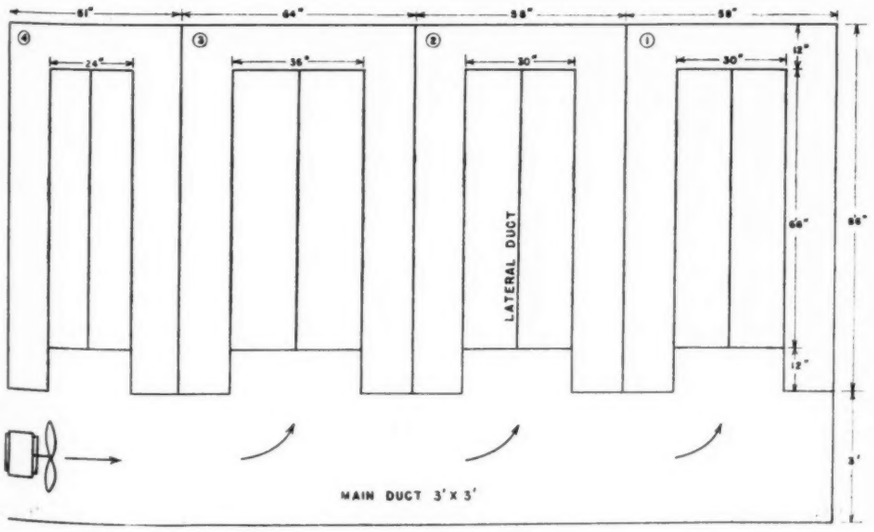
The second problem

The mechanical ventilating of small grain storage bins was the second point to be investigated. In this particular project the customer had four grain storage bins equipped with air ducts (Fig. 1). Each bin was equipped with a triangle-shaped lateral duct supplied from a main air duct. The lateral ducts were covered with ⅛-in. mesh hardware cloth supported by a frame of 1 by 2 in. strips. The necessary air was supplied by a 3-h.p. direct-drive, 18-in., 7-blade, propellor-type fan.

Static pressures were taken in the main air duct with a U tube manometer. Air velocities were read at the top of the wheat with a direct-reading velocity meter. C.F.M. per sq. ft. was calculated.

The fan was operated primarily from noon to 7.30 p.m., when the per cent. R.H. was 60% or lower.

The results are summarised in Table 2.



A plan view of bins and airducts

* Toledo Edison Co.

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Conclusions

From the material presented, the writer has come to the following conclusions:

1. Wheat can be satisfactorily combined at 23% moisture.
2. At relatively high moisture contents, the kernel is heavy and cleans up better. There is less chaff to overload the shoe and also less cutter bar loss.
3. From the stand-point of both combining and mechanical ventilation in storage 18% to 19% moisture content would be very satisfactory.
4. Bins equipped for mechanical ventilation increase the relative length of the 'combining day' in that the operator can start earlier in the morning and continue later in the evening.
5. Storage bins equipped for mechanical ventilation will enable grain to be harvested several days ahead of normal harvest time. This will provide the operator with wider latitude, with reference to weather conditions.
6. Mechanical ventilation will make it possible for grain to be harvested when the moisture in the kernel is going down. By this method test weight should be maintained.
7. Mechanical ventilation combined with a sound insect and rodent control programme will reduce farm storage losses to a minimum.

TABLE 2

	Bin Number 1	2	3
Date of filling	July 7, 1952	July 9 and 10, 1952	July 9, 1952
Variety of wheat	Seneca	Thorne	Thorne
Moisture percentage	15.7	15.7	80 Bu. @ 13.8 200 Bu. @ 15.7
Number of bushels	232	208	280
Depth of filling	7 ft. 2 in.	6 ft. 6 in.	8 ft.
Date fan started	July 8, 1952	July 9, 1952	July 9, 1952
Hours operation	29	23	23
Per cent. moisture finish	12.1	12.7	13.9
Plenum chamber S.P.	2.3 in.	2.3 in.	2.3 in.
C.F.M./Ft.² (top of grain)	14	17	14
K.W.H./bushel (total)	0.13		
Mean temperature °F. for period of July 8 to 13, from 1.30 p.m. to 7.30 p.m. each day—84°			
Mean per cent. R.H. for same period—40%			
*Test weight of grain	60.5	58.5	58.5
*U.S. grade	1	2	2

* Test weight and U.S. grade established by U.S. authorities

National Institute of Agricultural Botany Crop Conference 1953

THE barley crop was discussed at a successful conference recently organised at Cambridge by the National Institute of Agricultural Botany and attended by over 500 Fellows of the Institute, farmers, merchants and others. Dr. Hunter, Chairman of the Institute's Council and breeder of the well-known Spratt-Archer barley, described the general features of the crop and pointed out that although the barley acreage of this country has doubled, the amount used for malting has not increased, thus enabling the maltsters to be more exacting in their choice and emphasising the importance to the farmer of producing good quality grain.

Mr. C. S. Elliott described the results of N.I.A.B. variety trials, showing how Kenia and the Scandinavian types were improvements on the old established types such as Plumage-Archer and Spratt-Archer in field characters but now appear to be superseded by Proctor, Herta and Rika.

Commander Cory-Wright gave an account of malting quality and explained how samples from N.I.A.B. field trials were tested. The final judgment of a variety depends on the experience of the maltster and brewer in handling commercial quantities. He hoped there would not be too many barley varieties and thought three malting varieties enough.

Dr. Eden of the N.A.A.S. spoke of barley for stock feeding, emphasising that it was not in itself a complete ration. As a *coarsely* ground meal it was most valuable as the cereal component of a balanced ration.

Mr. Skelton, Chairman of the Seeds Committee of the N.A.C.A.M. emphasised the importance of purity of type in seed and described the field approval schemes supervised by the Seed Production Committee of N.I.A.B. He thought the scheme was well worth while and had reasonably improved the purity of seed.

A further section of the conference was devoted to the sugar beet crop, introduced by Mr. Oswald Rose of the British Sugar Corporation, who described the ideal beet variety as resistant to all diseases, unaffected by weed-killing sprays, combining high tonnage with sugar content, a large top for cattle consumption and a neat crown for easy topping.

Quality in wheat was the subject of a further session. Mr. L. Hector Read spoke of the economic importance of quality, while Mr. Sebert Humphries described the main qualities necessary for satisfactory milling and for baking. Millers seek a regular supply of first-class wheat for biscuit flour and of an entirely different type for bread-making flour. Mr. Denys G. Bullard, M.P., put the farmers' viewpoint, suggesting that it was not much of a bait to farmers to grow quality wheat if the most the millers could offer was a ready market and perhaps a small premium.

There were lively discussions after each session and the conference was summed up by Dr. G. D. H. Bell, Director of the Cambridge Plant Breeding Institute, the Chair being taken by Mr. Roland Dudley. A full report of the conference will be published in the Journal of the N.I.A.B.

National Institute of Agricultural Botany Council Meeting

At the recent quarterly meeting of the Council of the National Institute of Agricultural Botany, Prof. T. J. Jenkin, C.B.E., D.Sc., was elected chairman for 1954. He was formerly Director of the Welsh Plant Breeding Station, and Professor of Agricultural Botany of the University College of Wales, Aberystwyth. As his vice-chairman, the Council elected Mr. Herbert Lea, a director of H. J. Lea and Sons Ltd., a firm associated with the corn trade in Cheshire.

The Council received with great regret the news that Mr. E. W. K. Slade was relinquishing the chairmanship of the executive committee. He is to be succeeded as chairman by Mr. Roland Dudley. The Council elected over 150 new Fellows of the Institute, bringing the total number of Fellows very nearly up to 2,000. The date for the next N.I.A.B. Crop Conference was fixed as Tuesday and Wednesday December 14 and 15, 1954.

Grassland Management in Britain

In Great Britain attention continues to be focused increasingly on grassland management in connection particularly with the pressing problem of increasing food production and lessening dependence on imported foodstuffs. Recently, two conferences have taken place at which various aspects of the problems of grassland management were discussed.

THE first of two conferences on grassland management was arranged by the Agriculture Group of the Society of Chemical Industry and its Crop Protection Panel in London on November 17 last. It was divided into two parts, the first of which was concerned with the general management of grassland and grazings and the second with the eradication of weeds and mosses from grazing lands and turf.

Grazing management

The principal speaker in the first part was Dr. W. Davies, director of the grassland research station at Hurley. He pointed out that basically, plants, animals and soil are parts of one ecological environment but the grazing animal by the very act of grazing changes the ecological conditions. Swards represent a plant community each part of which makes its own demands on the soil and may react differently. Palatability is also important; in the United Kingdom Timothy grass ranks high in this regard but is sensitive to grazing and to competition. When sown in simple mixtures with clover it does well under rotational grazing but if it is grazed hard it tends to be replaced by other species.

In tropical grasslands the animal/plant relationships are interesting; grasslands are characteristically mixed, grasses are most palatable when young but legumes are usually absent or present in only small amounts. Often the grass flora is restricted to species able to withstand heavy grazing and repeated fires, and as a result tropical grasslands are of poor quality.

In most grasslands improvement is associated with changes that can be induced by sowing fresh seed, the use of fertilisers and better grazing management. Herbage yields are not exactly synonymous with output of animal production because this only measures the part of the grass crop utilised by the animal while rotational grazing greatly influences animal output.

In the United Kingdom grazing is limited by season and the long winter leads to a demand for extending the grazing season. There are not inconsiderable possibilities here which include the possibility of using grass species which have a longer period of active growth. Good management and dressings of fertilisers will promote summer growth, while good winter grazing can be produced by the use of suitable strains of grass with autumn resting and adequate dressings of nitrogenous fertilisers. There is ample scope for narrowing the winter gap by producing more grass and ensuring that the animal makes the fullest possible use of it.

So far as regards manuring high production of grass depends on good soil fertility. Acid soils respond well to lime while phosphates and potash dressings give excellent responses wherever they are needed. Nitrogen is, however, in a different case for even on highly fertile soils nitrogenous dressings can give big responses and it is often possible to increase herbage yields on very fertile soils by as much as 50% by judicious use of fertiliser nitrogen. In conclusion, Dr. Davies emphasised that the level of animal production from pasture lands is often an exact index of the effectiveness of the use of the herbage rather than of the actual production of fodder; there is need for methods of assessing accurately feeding value of grass crops.

Following on Dr. Davies' lecture, Dr. T. W. Evans pointed out that particular areas of grazing land naturally vary considerably in their inherent productive capacity, while there is inevitably a finite limit to the capacity of any one area to produce fodder. It is very desirable that some method should be available for estimating the productive capacity of land. He outlined a formula he had devised which made it possible to assess the potentialities of a particular area.

The eradication of weeds in grassland

The second session was concerned with the treatment of grazing land and laws for the eradication of weeds, the speakers being Dr. W. G. Templeman of Jealott's Hill Research Station, Mr. R. B. Dawson of the Sports Turf Research Institute, and Mr. R. V. Blandy of Messrs. Berk's Research Station at Tilgate.

Dr. Templeman explained that the principal weeds of grasslands are other grasses. Unfortunately no satisfactory chemical methods of eradication of these grasses are available which do not harm the useful species. However, a number of important broad leaved weeds of grasslands can be controlled by selective weedkillers such as MCP and 2,4 D. The economics of their use were examined bearing in mind the costs of treatments and the increases in production of herbage.

Mr. R. B. Dawson discussed the factors which determine what species of weeds survive and spread. He pointed out that regular mowing and surface scarification, accompanied by the appropriate top dressings, could go a long way to keeping turf free from weeds. The use of chemicals against weeds is still conditioned largely by the need to use treatments which do not harm the beneficial grasses. Selective weedkillers have partly displaced the use of sulphates of ammonia and of iron. All of these chemicals have their limitations and there is still a place for the hand grubber and the wire rake.

Mr. R. V. Blandy referred to the frequency with which mosses are to be found in lawns. He drew attention to the need to study the individual species and their preferences for particular locations. It is difficult to get rid of mosses by cultural methods and most chemicals used in the past have only had palliative effects. Calomel has recently been shown to be capable of giving good control and some of the work on this was described.

The second conference

The second conference took place on January 14 at Chelmsford and dealt with various aspects of grazing management. It was organised by the National Agricultural Advisory Service of the English Ministry of Agriculture under the chairmanship of Mr. B. H. Harvey, Principal of the Essex Agricultural Institute. In his opening remarks the Chairman stressed the importance of grassland in the United Kingdom and urged that farmers should think a great deal more about their grassland for it rarely receives the attention devoted to other farm crops.

The establishment of herbage seeds

The conference opened with a paper by Mr. A. G. Davies of Wye College, Kent,

on the establishment of herbage seeds, who quoted a Yorkshire report which showed that 22.6% of new grass seeds were poor, with 50% of the ground bare, or colonised by weeds.

Dry years saw numerous complete grass seeds failures in East Anglia, while partial failures were quite common. Partial failures or poor takes are far more serious than complete failures as farmers either did nothing about it, hoping that the poor patches would fill in, or merely attempted to patch up the blanks by over-seeding.

Temperature is probably the dominant factor in seed establishment and, with moisture, governs germination and seedling development. The ideal temperature varies between species and these differences are not necessarily of the same order when applied to the mature plant. Timothy is associated with cold climates, while Cocksfoot does well in dry climates and the Ryegrasses flourish in damp maritime climates in which there are no extremes. In low temperatures the clovers germinate quicker than grasses, particularly White Clover. Lucerne requires higher temperatures than Red Clover and night frosts retard Lucerne germination. The difference in the temperature requirements of Lucerne and Cocksfoot probably explains why Lucerne seedlings are competitive with Cocksfoot seedlings when sown in late summer.

Moisture and air are essential for germination and development. Experimental work 30 years ago showed that by shallow seeding these two factors could be combined to give the best results. Under dry field conditions, however, it is now accepted that drilling, even at the depth normally used for corn, deserves consideration.

Consolidation is important and critical evidence is available which justifies turning stock on to new seeds as soon as they germinate. This assists consolidation, prevents loss of moisture and benefits the young crop by the application of dung and urine, particularly when sheep are used for the initial grazing.

Discussing seed rates, Mr. Davies said that in theory 1 lb. of Ryegrass seed evenly distributed over one acre would provide five plants per sq. ft., if all seeds germinated and established themselves. Similar figures could be used for Red Clover, but species like Timothy or White Clover with their small seeds would give many more plants per sq. ft. The larger the seed the greater its chances of producing a plant. Generally speaking we sow more seed than is necessary, in fact even with a 20-lb. seed rate of a general mixture the wastage is fantastic.

Grass being picked up on a Sussex farm

Mr. Davies stressed the need for farmers to safeguard themselves when buying grass or clover seeds by asking for the certificate number, as they would do when purchasing seed potatoes or cereals.

Grazing management and utilisation of leys

Prof. M. M. Cooper of Wye College, Kent, next spoke on ' Grazing Management and Utilisation of Leys.'

All too often farmers accept recommendations to feed their milking cows on an arbitrary level of balanced production rations at 3½ to 4 lb. per gal. Attempts have been made to over-simplify what are, in fact, complex biological problems by providing formulae which can be applied in a rule of thumb manner. Although some cows at certain stages of lactation, and under first-class management, may exhibit this straight line relationship between nutrient intake and milk output, it is not true under ordinary farming conditions. The great majority of dairy cows exhibit something of a dual purpose function, particularly after the peak of lactation has passed, and commence to lay on flesh, which requires nutrients.

Quoting figures from the National Milk Costs Investigation Report for 1950-51, Prof. Cooper said it appeared that 3½ lb. of concentrates were used for every gal. of milk produced from a national herd which averaged 720 gal. per annum. If these concentrates were awarded their full value for milk production, of 4 lb. per gal., it meant that maintenance and 90 gal. of milk was produced from all the other feeding stuffs, *i.e.* hay, silage, kale, sugar beet tops and grazing. When allowance was made for the forage crops it appeared that grassland, in the form of hay, silage and dried grass did not account for more than maintenance and 50 gal. per cow. ' This is nonsense,' said Prof. Cooper, ' for it is the result of crediting concentrates and other foods with their full theoretical value and making grass the residuary legatee of all miscalculations and mismanagement.'

Its fallacy is shown by the experiences of Mr. John O'Neill, a North of Ireland farmer who, in 1952, stopped feeding concentrates to his herd altogether. Previously he had fed at the rate of 12 to 15 cwt. of concentrates per cow during each lactation and averaged 716 gal., the residual value of his grassland being 22 to 23 cwt. of starch equivalent per acre. After stopping concentrates, the utilised starch equivalent per acre, making full theoretical allowances for all milk and maintenance as well as the rearing of young stock, was 33.4 cwt. of S.E. per acre. This is equivalent to growing, and using without wastage, a 50 cwt. crop of equal parts oats and beans per acre over the whole of his farm. On the ' no concentrates ' policy, Mr. O'Neill's herd of 50 Ayrshire cows averaged 673 gal. from grass. Prof. Cooper considered that these figures were closely related to results in New Zealand where the average dairy farmer expects at least 600 gal. of milk from grass and its products. After three years the total milk production on Mr. O'Neill's farm rose from 33,000 to 37,000

gal., partly because of increased stock carrying capacity. Food costs fell from 17.4d. to 10.8d. per gal. at a time when food costs were rising steeply, and the gross profit margin (*i.e.* the difference between food costs and total receipts) rose from £48 to £74 per cow.

Discussing the results of feeding silage to dairy cows at Wye, Prof. Cooper said trials had shown that the intake of wet silage was influenced very little by its dry matter content. Palatability and possibly certain physical attributes of the silage appeared to be more important. At the higher dry matter levels, however, there was a marked increase in the intake of silage in terms of dry matter. It also appeared that when wetter silage was offered the cows would eat more hay. When silage was used as the main feed for the herd the speaker recommended that any additional hay fed should be of first-class quality.

The electric fence was most useful. Experimental work had shown that it increased efficiency of grass utilisation by at least 25% and also provided a means of rationing the cows while at grass. Prof. Cooper recommended quick utilisation of growing herbage, followed by resting periods of between two and four weeks, depending on seasonal conditions. The use of a back fence successfully limits the area being folded.

Pastures for winter grazing

The subject of 'Pastures for Winter Grazing' was discussed by Mr. G. P. Hughes, Grassland Research Station, Stratford-on-Avon. The station farm consists of 460 acres of mainly heavy clay land. All old grass, except 7 acres, has been ploughed and re-seeded. Cattle for experimental purposes are purchased in the spring as yearlings and are sold off at $2\frac{1}{2}$ years of age with little or no hand feeding. Due to the re-seeding policy fertility has been built up, resulting in increased stock carrying capacity.

Describing trials on winter grazing, Mr. Hughes stressed that the aim was to maintain the cattle in good condition during the winter months until the spring flush of grass appeared, and except in extremely severe weather no hay was fed. It was found that the swards deteriorated rapidly during the winter grazing periods, White Clover suffering particularly badly, while weed population increased rapidly.

In 1950 it was decided to experiment with Lucerne as part of the seeds mixtures and this policy has been extremely successful. The Lucerne was drilled with other selected grasses, in alternate drills, 1 ft. apart. When a mixture of 3 lb. S.37 Cocksfoot and 5 lb. Lucerne was drilled, the Cocksfoot dominated the Lucerne before cutting for silage, but the Lucerne more than held its own when the time arrived for the second cut. At the end of the season the Lucerne still showed good growth, while Cocksfoot growth had stopped altogether.

The system practised proved that cattle could be carried at the rate of one per acre in the winter, with greatly increased numbers during summer. During the summer of 1953 on the Cocksfoot/Lucerne mixture, it was found that 11 Hereford bullocks made an average gain of 219 lb. per head. This was achieved on three two-acre plots which were intensively grazed by six steers during the whole of the previous two winters.

The Lucerne did not suffer from winter treading and the stand at the end of its third harvest year's growth was very satisfactory and vigorous. Mr Hughes felt that planting Lucerne and grass in alternate rows, 1 ft. apart, gave the Lucerne sufficient space to fulfil its own growth requirements without competition from the accompanying grass. He stressed the value of feeding off the herbage by strip grazing, using the electric fence, followed by immediate protection from grazing, by bringing up a back fence behind the steers.

Photo: Ford Motor Co.

Fertiliser Notes

Mineral fertilisers

Results of a 50-year experiment on fertilisers show that mineral fertilisers give a higher yield than farmyard manure. The tests, reported by K. Iversen, Research Station, Askov, Denmark, were conducted in Askov during the period 1894 to 1948 on loamy and sandy soils.

In order to avoid fluctuations in the nitrogen, phosphorous and potassium content of the mineral fertiliser during the lengthy test period, the fertiliser was compounded so as to have constant levels of these elements. Because of loss and fixation of nitrogen, organic fertiliser was found to have only 40% as high an effective nitrogen value as mineral fertilisers. However, owing to its slow decomposition it was found to have a greater after-effect. The plots which had been fertilised with organic manure for 50 years showed a higher content of nitrogen and carbon than did the plots fertilised only with mineral fertiliser. The plots fertilised with minerals also showed the greatest concentration of phosphorus, but microbiological activity was greatest in the plots fertilised with organic manure. Analysis of the soil showed that about 10% of the nitrogen remained in the soil after the 50-year treatment.[1, 2]

Superphosphate manufacture

Development of a new process for manufacturing super superphosphate has been reported by J. C. Broshear, Tennessee Valley Authority, Wilson Dam, Alabama. The new process produces calcium metaphosphate fertiliser which contains 64-67% phosphorus pentoxide as compared to the 20% contained in ordinary superphosphate.

The scale model plant which has been set up demonstrates the simplified operation of the process. White phosphorus is burned in an excess of air in a combustion chamber. At the same time, rock phosphate which has been ground to a fine dust, is blown into the chamber. The burning phosphorus reacts with the rock dust to form molten calcium metaphosphate which falls as a fine rain to the bottom of the combustion chamber where it collects in a pool. A tap under the chamber allows the molten material to flow on to a rotating drum. The drum, cooled by water circulating through the inside, chills the molten fertiliser. The fertiliser hardens into a brittle material which flakes off and is then ready for use. The heat of combustion is said to be more than enough to keep the process going.[3, 4]

Soil bacteria growth

That phosphorus will stimulate the growth of soil bacteria is evident in tests conducted by H. Glathe, Braunschweig-Volkenrode, Germany. After an acid forest soil had been cultivated for two years the application of 200 lb. of phosphoric acid per acre was found to increase the content of organic carbon in the soil from 2,171 mg. to 2,729 per 100 g. of soil. The increase was due to the increased activity of the cellulose-decomposing bacteria. Actinomycetes and other soil organisms also showed increased activity as the rate of phosphorus applied to the soil was increased. However, actinomycetes and the cellulose-decomposing bacteria, after initial stimulation, began to show some decrease in activity at the higher rates of phosphorus application.[5, 6]

C. H. C.

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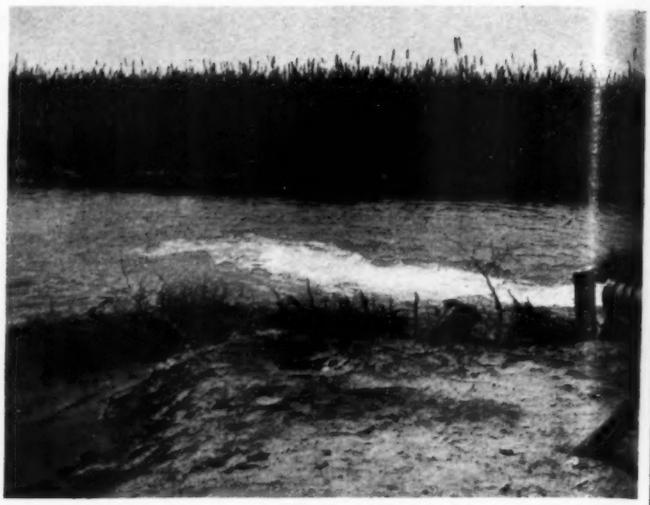


(*Left*)—**Typical salt affected land one year after going out of cultivation.** (*Right*)—**A good crop of sorghum near a tube well**

Sinking a tube well

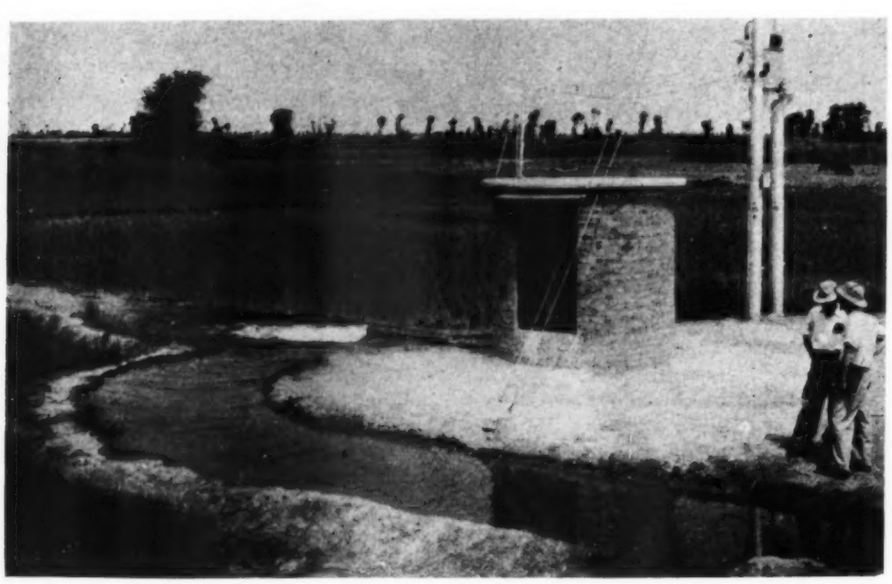
The Chuharkhana Reclamation Project in the Punjab

A GREAT deal has been written about reclamation of lands infected by ' thur ' (salinity) and ' sem ' (water-logging) in different parts of the Punjab. The magnitude of the problem, however, is realised by only a few people outside the handful directly concerned with the task. Shortage of water to flood ' thur '-affected fields, which is now the accepted curative method, has been the main difficulty in the way of a general drive to fight the menace.

Recently an encouraging beginning on a scale wider than attempted hitherto has been made near Chuharkhana Mandi, in district Sheikhupura, where the face of an area of 11,000 acres is being changed from decades-old desolation to prosperous green fields. Although the methods employed during the last 15 years by the Land Reclamation Department of the Irrigation Branch have been approved by foreign experts the details needed improvement with regard to layout of fields and general soil management; the project now under way is being conducted with the active association of the Food and Agriculture Organisation.

FAO wanted to start a ' pilot project ' somewhere in the ' thur '-affected regions and the site near Chuharkhana was selected by its experts and the officials of the Central and Punjab Governments after due consideration of the scope offered by it for finding a solution of the problems of saline regions.

Early last year a meeting was held between representatives of the Centre, the Punjab, FAO and TCA (Technical Co-operation Administration), and it was decided that the FAO should start three pilot projects, followed by bigger projects to be financed by TCA, ending with a province-wide campaign for applying the lessons learnt from the first two ventures to extensive reclamation through tube-wells and other means. In the meantime a survey of ground-water resources was to be carried out by the Government.



A completed tube well

Area of the project

The Chuharkhana Reclamation Project includes the villages of Chuharkhana, Kot

Part of an experimental plot

Sondha, Bhandore, Nokhar, Manga and Orwidka. This area of about 11,000 acres is situated in a high-water-table zone and consists of land giving generally low yields due to excessive salinity and water-logging.

The immediate objectives are (1) to gain experience in the organisation of such a project and the planning of facilities for the drainage and reclamation of water-logged and saline lands and (2) to establish improved methods of agriculture and irrigation which can be profitably applied to the vast deteriorating areas in the Indus Valley.

The ultimate objectives can be cited as increasing agricultural production, improving the sanitary and health conditions and thereby raising living standards of rural people and providing economic and social benefits to the affected communities. That these objectives are well in sight is proved by even a cursory examination of the results achieved within the year at Chuharkhana. Today, where nothing had grown for years and the soil was surfaced with white encrustations of salt (kallor), fairly healthy crops are now growing. The net increase over the area sown in previous years is 766 acres and the general condition of the *kharif* crops is far better than that of crops grown hitherto. There is also an appreciable increase in crop yields due to higher water allowance and better preparation of land.

Some results

These results have been achieved through the concentrated efforts of the Land Reclamation Department and the co-operation and advice of the FAO experts. The material contribution has been in the form of 24 tube-wells which have been spread over the area and supplement the canal water. These not only help to reduce the sub-soil water table but also supply an abundance of water, a basic requisite for any scheme of reclamation.

An area of 117 acres has been set aside to serve as an experimental-cum-demonstration plot. The experiments on this farm will cover a wide range of soil and agricultural problems through a study of suitable crop rotation systems, etc.

The psychological effect of the project has been even more far reaching than the increasing material prosperity which it promises for the people. There is already considerable confidence in the market. The business of the *mandi* has leapt from Rs. 16 lakhs to nearly Rs. 80 lakhs during one year. The increase in area under food crops has made the local cultivator realise that something can be done in the Chuharkhana area and that it can be made to yield profitable crops.

Difficulties

Things, however, have not been easy for the reclamation officials. They have had to overcome a host of prejudices and break down the stubborn resistance with which the Zamindar invariably confronts any new idea which entails extra work.

The position in regard to allottees of agricultural land in the area (which is mostly evacuee property) was also not very happy at first, until a lot of patient remonstrance convinced them that the project was in no way designed to affect their interests adversely. It has been decided that no existing tenant is to be ejected or displaced unless his conduct or attitude towards the project is harmful. This rule applies to all persons in the area, whether they are temporary allottees or provisional permanent allottees. Some of the Zamindars tilling land in this area at first refused to avail of the tube-well water, labouring under the impression that it would harm their fields. Now, however, they are beginning to relent after seeing the effects on their neighbours' fields where 15- to 20-year-old jungle has given way to healthy-looking crops.

The 24 tube-wells which were sunk and installed in June last year are under constant observation and regular readings are taken to work out their cost, drop in water, efficiency, etc. Instead of the previous policy of placing them along a canal these tube-wells have been spread over the project area and an effort is made to synchronise their waters and those of the canal in such a way as to achieve the maximum benefit from both.

The Chuharkhana Scheme was intended to be taken up by the Punjab Soil Reclamation Board set up early this year, but

(*Left*)— **Typical salt affected land with water level near the surface.** (*Right*)— **First crop of rice on typical land under reclamation four months after pumping commenced**

due to difficulties in fulfilment of legal conditions actual execution was considerably delayed and the scheme could not be taken up immediately by the Board. Meanwhile the Punjab Government decided to take up the scheme under the 'Grow More Food' campaign for a period of one year, which expires on March 31, 1954 whereafter the Board, which is a corporate body on the lines of the Thal Development Authority, is expected to handle the scheme.

This project is soon to be followed by two other pilot projects, one near Jaranwala, which is badly affected by *thur* and *sem*, and the other near Sukhaki. While reclamation work goes on the FAO experts are also devoting attention to other allied matters. A comprehensive soil survey is being conducted which will enable all agricultural land in the Punjab to be classified. Reclamation work is expected to become much simpler and easier when this is complete.

(From the *Pakistan Times*)

The Seventh Session of FAO took place recently in Rome and a report of it appeared in our last issue. We have since received some photographs taken at the meeting. (*Above*) **One of the meetings in progress.** (*Below, left*) **Mr. Norris Dodd, the retiring FAO Director-General, and** (*right*) **Mr. Philip Vincent Cardon, the newly-elected Director-General of the organisation**

Dutch Production of Aldrin and Dieldrin

Scheduled for immediate construction and for completion by mid-1955 a new plant at Pernis (Rotterdam) refinery in Holland will make available for world-wide distribution the insecticides, aldrin and dieldrin. With production hitherto confined to the U.S.A., the use of these products in many countries has been limited because of currency considerations. However, quite large quantities have been made available in certain countries through the U.S. Government aid programmes, particularly for locust control and public health applications. The plant to be erected in Holland, at an estimated cost of more than £1,000,000, will make these materials more readily available throughout the world. In view of the importance of these two products in agriculture and public health, plans have been laid to manufacture them in such quantities as will satisfy not only Shell's own requirements but also the needs of other insecticide manufacturers wishing to use aldrin and dieldrin as the base material for their own products.

A comprehensive development programme has been carried out with aldrin and dieldrin on a world-wide basis and it is said that it has confirmed the value of these materials for the control of soil insects, cotton pests, locusts, ants and many other insects. In particular, the extreme potency and long residual action of dieldrin make this compound invaluable for public health work. Unlike other insecticides, it will control both the Anopheline and Culicine mosquitoes which are respectively the carriers of malaria and filariasis. Their great biological activity makes it possible to use these insecticides at application rates which are a mere fraction of those needed for other insecticides such as DDT and BHC.

London meeting

A press conference was held in London recently to introduce the two insecticides to the United Kingdom market. The three branded products at first available will be 'Aldrex Wire Worm Dust,' 'Aldrex 30' and 'Dieldrex 15.' Aldrin and dieldrin have been discussed in two articles in WORLD CROPS (June 1953, page 224 and July 1953, page 277).

The Second Weed Control Conference

The Second British Weed Control Conference will take place in Scarborough on November 2–4, 1954.

National Institute of Agricultural Engineering

The Minister of Agriculture and the Secretary of State for Scotland have jointly appointed Major-General Sir Harold Wernher, Bart., G.C.V.O., T.D., to be Chairman of the Governing Body of the National Institute of Agricultural Engineering in succession to the Rt. Hon. the Earl of Radnor, K.C.V.O., who has resigned owing to pressure of other business. The Ministers have expressed their appreciation of Lord Radnor's valuable services to the development of agricultural engineering research.

Helicopter Spraying for the Control of Leaf Disease of Rubber in Ceylon

AT a recent press conference Dr. W. E. Ripper, managing director of Pest Control Ltd., gave information regarding the operations of his company in relation to the spraying of crops for disease control by means of helicopters and particularly in regard to the aerial spraying of rubber in Ceylon for the control of the leaf disease *Oidium heveae* which, at present, occasions serious losses in the higher rubber lands of that Dominion.

In the course of his speech Dr. Ripper pointed out that it was in Britain that the first attempt was made to use the helicopter as an agricultural implement and that it would shortly be 10 years since his firm had filed the first patent for spraying by helicopter.

The development of the 'spraycopter'

Early research work was carried out by Pest Control Ltd. at Bourn aerodrome, Cambridge, working in collaboration with the Royal Aeronautical establishment at Farnborough, the Royal Air Force and the Ministry of Supply. This led to the design of spraying gear for commercial use. Subsequently an American-built Sikorsky S.51 helicopter was acquired by Pest Control Ltd. and a few months later two British-built Westland Sikorski 51s.

With this equipment Pest Control Ltd.'s aerial crop spraying service was inaugurated in 1949, since when it has been possible to make a considerable contribution to the control of pests on agricultural crops by helicopter spraying, which has proved a most valuable tool for the treatment of crops too tall for spraying from the ground. or where irrigation ditches or other obstructions make the use of tractor-operated equipment difficult or impossible. It was also found that it was possible to deal with small fields more effectively than by the use of ground sprayers because in small fields the turning of a tractor-operated sprayer on a headland can cause appreciable damage. In this connection the company coined the word 'spraycopter' to describe a helicopter used for spraying. which is now accepted currently in technical circles.

Uses of the 'spraycopter'

The spraycopter is used in Britain extensively for the control of potato blight in Lincolnshire and the Fenland. Its usefulness has also been proved for the application of weed-killers and liquid fertilisers to grass on marshes, pastures and marginal grassland; particularly on marshes and on grassland on hills, there is no ground spraying machine which can carry out the work adequately, and the spraycopter has a very important application. Also, weed control on grassland must go hand in hand with fertiliser application and equipment has therefore been evolved for the application of solid fertilisers by spraycopters, which has proved successful.

The spraycopters have also done good service in the treatment of potato fields against the Colorado beetle, not only in England under contract for the Ministry of Agriculture, but also in Normandy for the 'Organisation Europeene pour la Protection des Plantes.' Spraycopters have been used also for the spraying of orchards, and for the treatment of seed crops for the control of pests like aphids and pollen beetle, because with their peculiar aptitude for dealing with small fields, they are suitable for these expensive and often tall interlaced crops. Pest Control Ltd. have also used spraycopters in overseas countries and, indeed, depend on their use overseas in order to find off-season employment during the English winter.

Performance

In all this research work the performance of the spraycopter has been compared with that of the sprayplane in order to assess exactly where the aeroplane should be used and where the helicopter is the right tool. In exploring these possibilities helicopters have been sent to many parts of the world where they have never been before, *e.g.* to the Sudan, Central and South Africa and Ceylon. In the Sudan a big crop spraying operation on cotton has been undertaken which has increased the production by something like 40% in seasons of bad jassid attack.

Overseas aerial spraying operations extend also to Kenya, where sprayplanes are used for the control of locust swarms in the air, under contract to the Desert Locust Control. Aerial spraying operations have also been carried out on cotton in Turkey and the use of aeroplanes has also been studied in order to get an idea of the difficulties presented by forest spraying, particularly in mountainous country.

Oidium leaf disease in Ceylon

Rubber production in Ceylon has been much affected by the damage caused by the fungus disease, *Oidium heveae*, rubber leaf mildew. This disease affects the young foliage and causes the leaves to fall prematurely. According to the Rubber Research Institute of Ceylon, several (four or five) defoliations per year reduce the amount of latex which can be collected from the tapping panel by up to 40%; the repeated defoliation also weakens the tree, and the losses in yield result in inefficient exploitation of capital equipment.

Loading the spray tanks of a helicopter

Earlier work

Efforts have been made to combat the disease by sulphur dusting, using hand-manipulated motor dusters, because on the hilly rubber plantations of Ceylon bigger equipment can only be used if an extensive and costly system of roads is installed. The small power dusters have to be hand-manipulated, so that there is a severe *limitation in size*, and the models used at present are not adequate for proper penetration of the canopy of tall trees. Aerial spraying was considered some time ago, but it was then thought that the steep hilly rubber plantations could not efficiently be sprayed from the air because of the difficulties of flying; it was also considered impossible to deal adequately with the various clones of rubber which winter, and therefore produce new leaves at *varying dates*, by spraying the whole territory under rubber at one time. The use of aircraft was therefore not attempted.

In the meantime, the Rubber Research Institute of Ceylon, under the directorship of Dr. Young, made further progress and found that the use of liquid sulphur sprays instead of dust gave promising results. This is in accordance with general experience on other crops, where liquid sprays have proved more economic and effective than dusts.

Recent developments

When Dr. Ripper visited Ceylon in April 1953 he investigated the possibilities of using helicopters. With the experience which Pest Control Ltd. had acquired in the spraying of difficult mountainous forested territories in Switzerland and other places, and after detailed inspection of the rubber plantations from the air, he came to the conclusion that spraycopters, piloted by experienced pilots, could carry out rubber spraying successfully from above. Moreover, while there are some fields with mixed clones, it was also obvious that the majority of clones are planted in plots of a size comparable to the fields on British farms, and that therefore it should be possible to deal with individual clones at one time, just as it is possible to spray single fields in Britain, provided one can clearly establish the boundaries of the individual clones by the use of markers.

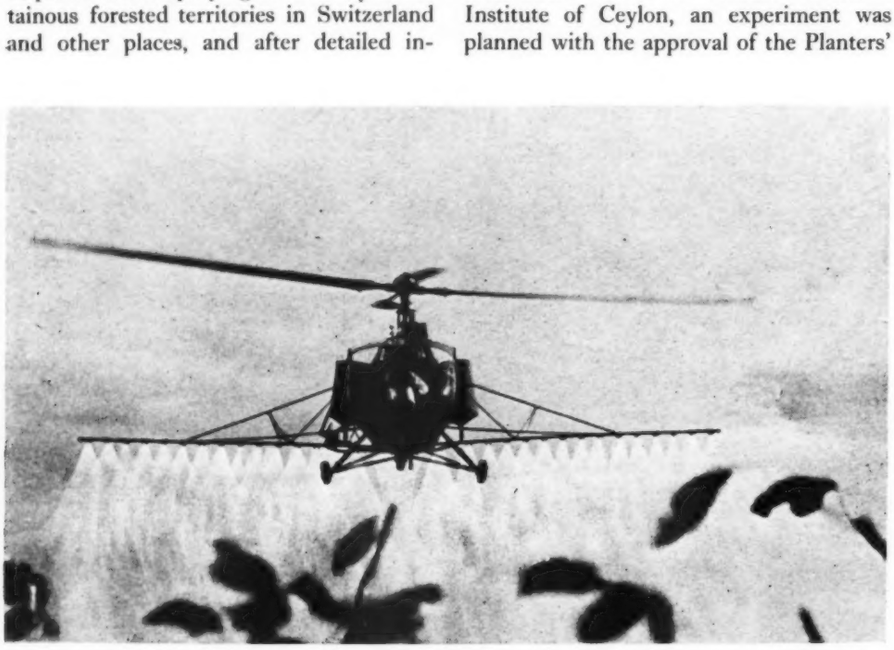
On the strength of this assessment, in association with the Rubber Research Institute of Ceylon, an experiment was planned with the approval of the Planters' Association of Ceylon. Eighteen estates agreed to participate in this experiment, on which Pest Control spraycopters would apply on over 2,500 acres five applications, using two different sulphur preparations, the individual applications being timed according to the wintering and appearance of new foliage. A contract for this experiment was first discussed between the rubber estates and Pest Control Ltd. as a private venture, but subsequently the Ceylon Government made a grant of Rs. 100,000 towards the expenditure, because of the great importance of the project.

A helicopter at work

The rubber industry has co-operated in a very progressive way, but for experimental reasons not all estates which offered could be accepted.

Spraycopters and special aircraft supply tankers designed and built by the company, were shipped to Ceylon and have now been assembled there; initial trials have been carried out, demonstrated that rubber can be adequately sprayed from the air, and the full-scale spraying campaign has begun.

The development of the right spraying technique and the selection of the right droplet sizes and spray nozzles, is in the hands of one of Pest Control's senior biologists, Mr. C. J. Edwards, B.Sc., who has been seconded to the Rubber Research Institute of Ceylon for the period of this experiment, to ensure that it is carried out so as to satisfy the high standards of statistical significance which the Rubber Research Institute require in order to assess whether the yield increases in rubber obtained by this mehod will justify the somewhat higher cost of aerial spraying as compared with the present technique of sulphur dusting.



A close-up of a helicopter in action

Rice Cultivation in Italy

RICE cultivation plays an important part in the economic life of the Italian nation. For 22 years the responsibility for cultivating and marketing has been mainly vested in a special authority, the 'Ente Nazionale Risi.' On the occasion of their 20th anniversary two years ago, and again on the occasion of their prominent participation in the International Agricultural Exhibition in Rome last year, the E.N.R. have issued some publications which contain interesting particulars on the subject of rice cultivation and rice processing in Italy.

About 90% of the rice cultivation in Italy is concentrated in the Po Valley provinces of Vercelli, Novara, Pavia and Milan where rice cultivation plays a prominent part in rural community life. The remaining rice areas are spread over isolated points in the provinces of Bologna, Modena, Ferrara, Rovigo, Verona, Mantova, Alessandria and Cremona.

Cultivation is generally entrusted to well-organised and efficiently-managed farms with considerable labour forces and mechanical equipment at their disposal. It is, in fact, believed that rice cultivation in Italy is among the most efficiently organised agricultural pursuits in the world. One of the results of this high degree of industrialisation is the large-scale introduction of the 'transplantation' method, whereby rice is produced, in the same year, on fields which have already yielded some other crop. Such intensive soil utilisation now extends to nearly 40% of the entire rice-growing area. As it is possible to make efficient use of manual labour, rice cultivation is an important means of reducing the high degree of unemployment in the country. In normal times, some 250,000 people are employed in this industry.

The success of rice cultivation in the Po Valley is largely due to the extensive system of drainage canals which dates back, in part, to the 11th century, and which has been systematically extended and improved in the course of the centuries. At the time of the greatest extension of the rice fields, after the opening of the Cavour Canal in the 1870s, nearly 600,000 acres were under cultivation. Subsequently the rice-growing area has contracted, due partly to plant diseases and partly to the growing competition of Asiatic varieties. At the same time, however, owing to the introduction of modern scientific methods, the yield per acre has been trebled compared with the 19th-century yields.

The Rice Production Board

In the wake of the world economic crisis of the early 1930s, the north Italian rice industry was faced with ruin. It was to cope with this situation that the 'Ente Nazionale Risi' was founded in October 1931 for the protection of the national rice production and the industrial and commercial undertakings linked with it, for the promotion of rice distribution and consumption and for the systematic improvement of the product and of the production methods.

By insisting on high quality, the E.N.R. also succeeded in building up a considerable export market. Moreover, funds were made available for the overhaul and mechanisation of the rice farms. Owing to these measures, and the systematic promotion of the home market, the E.N.R. were eventually able to lower the cost of production and thereby again to increase the consumer market.

Having thus been placed on a sound commercial basis, the rice industry was one of the first to achieve normality after the critical war and post-war years. At the beginning of the 1949-50 campaign, the E.N.R. had fully resumed their peace-time activities. A new plan was adopted which included the judicious use of stock-piling for the purpose of stabilising the prices. Under this plan, which met with some opposition at the outset, the producers receive payments 'on account,' whilst the final unit prices are worked out according to the overall sales at the end of each campaign. With the aid of this scheme and with the resumption of home market propaganda, the annual production has now reached a level of 9 million cwt.

At present, the E.N.R. are again carrying out an ambitious programme of technical modernisation, constructing new warehouses and desiccators, carrying out large-scale research, etc.

Products of the rice industry

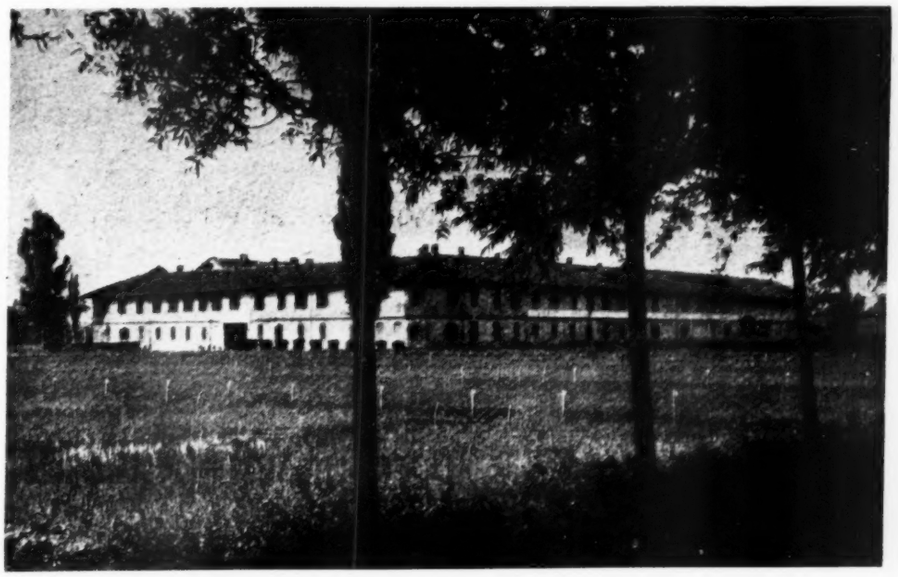
Having been gathered and dried, the rice is subjected to various industrial processes before being fit for consumption. The ripened rice is threshed and hulled so that the husk may be removed; the refined product is then either treated with oil, or polished. Among the by-products of rice processing are the chaff and flour-dust which are utilised for cattle feeding, whilst the so-called semi-grain and broken grain is used, *e.g.* for the production of starch and toilet powders.

Apart from the equipment of the farms themselves, there are at present over 700 rice-processing plants with an aggregate annual capacity of about 24 million cwt.

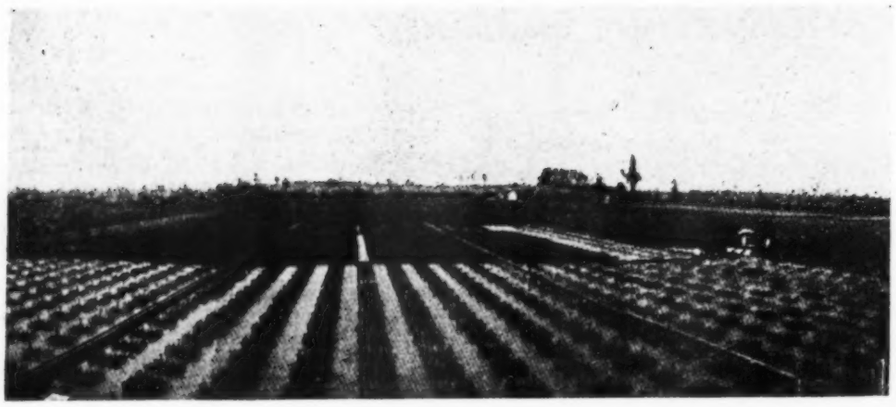
The most important rice consumption centres are to be found in northern Italy. The rice trade is centred on Milan, whilst Savona, Genoa and Venice are the main ports for rice export.

The quality of Italian rice

Owing to the high standard of research and production and the favourable climatic conditions in the Po Valley, Italian rice has a high nutritional value. This is mainly due to the comparatively long vegetative



The Rice Research Institute at Vercelli



An experimental field of rice varieties

period which enables the plant to absorb a comparatively great quantity of nutritive substances, and to the uniform ripening process favoured by the absence of violent temperature fluctuations.

Italian rice has a protein percentage of over 7 and is extremely rich in energy-building carbohydrates (77% to 79%) with high vitamin contents. A particular advantage of the Italian rice varieties is their high cooking resistance. The cooking time is 17 to 24 minutes and, as the rice does not get pulpy, it is particularly suitable for savoury dishes.

The export market

In 1951-52, the export of Italian rice reached a level of 3½ million cwt., far in excess of the annual export before the war. The principal markets are Germany, France, Switzerland, Austria, the Netherlands, Britain and Denmark. In recent years, exports to the Far East have also begun. The rice exported from Italy is subject to a strict quality control, and must be certified by a special control office. The sacks are labelled and sealed, carrying the name of the export firm, that of the country of origin and that of the official quality mark, distinguishing between large-grain, long-grain and round-grain varieties.

The Rice Research Station at Vercelli

In 1908, long before the foundation of the E.N.R., the rice farm associations in Novara and Vercelli Provinces founded the Rice Research Institute at Vercelli, which has since become the centre of Italian research activities on rice cultivation. In addition to the chemical laboratories, the Institute runs an experimental farm and an experimental irrigation field outside the town, as well as genetic and piscicultural laboratories. The Institute possesses a fine collection of the principal varieties of rice grown all over the world.

The technical-scientific activities are organised in sections, each with its own officer responsible to the director, who, in his turn, is responsible to the Council of the Institute on which the Ministry of Agriculture and Forestry and the various interested groups are represented. The costs are borne partly by proceeds from the farms, partly by Government and private contributions. Most of the staff have the status of Government employees, and the Institute itself has the status of a university college.

During the many years of its activities, the Institute has been able to make important contributions to rice-growing problems such as rice field fertilisation, rice threshing and drying technology, utilisation of by-products, the cultivation of improved varieties of the plant, etc.

The Need for Increased Production

Looking ahead, agricultural scientists see a world-wide need for increasing the production of food per acre. Such increased per-acre production of food will be necessary, according to Dr. K. Starr Chester, Battelle Institute, Columbus, Ohio, because the number of acres available for farming is declining while populations are rising sharply. Dr. Starr Chester was speaking at the Mid-Century Conference on Resources for the Future in Washington recently. He emphasised the importance of making plans now to anticipate the world's future needs, saying, ' We should not be misguided by present American farm surpluses, which, viewed against long-range food needs, are, in all probability, but a temporary dislocation in our farm production and distribution system.'

Dr. Starr Chester said that conventional farm production in the United States alone could be increased at least 80% if proved methods of scientific farming were practised more extensively. Among these methods are included soil and land conservation, mineral fertilisation, pest control, irrigation and drainage and the use of more productive varieties of crops and livestock.

He referred to the following as unconventional measures, still in early stages of development, which show promise of increasing per-acre food production beyond that of conventional agriculture: hydroponics or the culture of plants in sand, gravel or water; fresh-water fish farming; chemical, non - nutritive promotion of animal and plant growth; and the culture of fresh-water algae for food and feed.

Full production can only be attained, he said, if all necessary production factors are applied in a balanced manner. It does little good, for example, to fertilise if water is the limiting factor. It does little good, furthermore, to draw up plans for improving per-acre food production if proper economic incentives to ensure their fulfilment are not provided to farmers. Proper economic incentives should include provision for the efficient distribution and use of agricultural products.

Lubrication Chart

C. C. Wakefield and Co. Ltd., makers of Agricastrol tractor oil, have produced a lubrication chart for the Massey-Harris 744D tractor. Copies of this chart, which measures 22 in. by 17 in., may be had free on request to the company.

Technical News

The March issue of *Fibres* (*Natural and Synthetic*) deals with hard fibres and among the articles are ' Concerning Sisal Products,' ' The Making of Brushes,' ' Fibre Used in Rope Manufacturing ' and ' Venezuela Expands Sisal Growing.'

Food Manufacture for March includes ' The Milling Industry, Part 2,' ' The Vitamins, Part 1 ' and ' Processing of Passion Fruit.'

Included in the March issue of *Petroleum* is an article by P. W. Sherwood on ' Modern Practice in Natural Gas Dehydration,' and Dr. T. F. Gaskell writes on ' Seismic Prospecting in Deep Oceans.'

Bars of pressed chicle ready to be loaded

Chicle

BY far the most important forest product of British Honduras, other than timber, is chicle, a gum prepared from the ' latex ' of the sapodilla tree, *Achras sapota*. This is exported to the United States, Canada and the United Kingdom for the manufacture of chewing gum, coming next to mahogany in value of exports.

The best chicle comes from the privately owned forests of the north of the country; an inferior quality from the south is known as Crown Gum. The sapodilla tree also yields a very durable timber which was much used by the ancient Maya.

Tapping

The gum is obtained by ' tapping ' or ' bleeding ' the tree. V-shaped cuts are made with a machete up the trunk and the gum is collected in a small rubber-coated bag fastened at the base of the tree. The cuts are made only one-half or two-thirds of the way round the trunk. After a tree has been tapped it should be left for from three to five years before being tapped again. ' Girdling,' that is cutting completely around the trunk, overtapping or cutting too deep kills the tree. The production of chicle has fallen off owing to exhaustion of stock due to careless and unscientific methods of tapping, and there are now many dead and dying trees in the forest. Attempts are being made to introduce new and better methods of extraction, and large areas in the southern limestone country are now being opened up for chicle tapping.

(*Top*)—A chiclero tapping a sapodilla tree for latex. (*Centre*)—A chiclero emptying latex into a kettle. (*Below*)—As the chicle sets, it has to be stretched at frequent intervals

Chicleros

' Chicleros,' as the tappers of chicle gum are called, usually work in small gangs of six to ten men. The gangs are scattered throughout the forest and seldom work outside a radius of more than 1½ miles from their camp. When the area around the camp is worked out, a new camp is made in an adjoining area of untapped forest. Camps are moved usually every two or three weeks. Huts therefore are of a very temporary nature and consist solely of a roof thatched with palm leaves.

The chicleros, like the mahogany workers, are piece workers. Usually they start work as soon as it is light enough to see their way through the forest. They are back in camp in the early afternoon with the gum collected during the day. The gum from the small collecting bags is emptied into a larger bag in which it is kept until the end of the week when a sufficient quantity has been gathered for curing.

Tapping can be carried on only in the wet season, as it is only then that the latex flows freely, and the chiclero is in consequence almost continually wet.

Exports

Chicle is prepared for export by heating the latex in a large iron pot until it coagulates and the greater part of the

(*continued on page* 126)

CORRESPONDENCE

Spray Nozzles

TO THE EDITOR

Dear Sir,

Your November 1953 issue of WORLD CROPS has been brought to my attention with special reference to pages 467-468 covering letters and opinions on rotary and other atomising devices for the production of insecticidal aerosols.

The writer, contary to some of the expressed opinions, knows of no means of producing a ' completely homogeneous aerosol ' in the generally-accepted insecticidal range of 5-25 microns MMD, whether rotary, pneumatic or hydraulic nozzles are used. The findings of Drs. Langmuir, Sheafer, LaMer, Hochberg, Yeomans and others substantiate the above statement.

The findings of Dr. Yeomans and others of the Bureau of Entomology and Plant Quarantine (U.S.D.A.), published in various reports of that Department, should prove beneficial to those interested in this subject, as they are the result of extremely able and painstaking research.

It is indeed gratifying to note that the general study of particle size is receiving the accelerated attention it has long deserved—which will undoubtedly soon lead to new and more efficient atomisation methods.

Yours faithfully,

JOHN W. HESSION, JR.

Research and Development,
John Bean Division,
Food Machinery and Chemical Corp.,
Lansing 4,
Michigan, U.S.A.

Insecticide Equipment

TO THE EDITOR

Dear Sir,

I have read your journal for some considerable time, and have been extremely interested in the frequent articles on equipment for applying insecticides.

My colleagues and I are concerned with the formulation of insecticides, wood preservatives and sheep and cattle dips, and various other products which require mechanical application. We welcome the introduction of new types of machinery for the application of insecticides as being a great stimulus to our industry, but I would like to make some observations of a general nature concerning the introduction of new equipment employing, in some cases, revolutionary methods.

Just as the inherent toxicity of an insecticide can be made or marred by the manner in which it is formulated, so can the performance of a machine be affected by the suitability of a formulation. The Insecticides Division of my company has concentrated on the correct formulation of insecticide materials for use in specialised equipment, and our contact with manufacturers of such machinery have been interesting, pleasant and stimulating. I do feel, however, that in some cases equipment is launched on to the market without sufficient preliminary study of the problems which can best be tackled by it, and without adequate knowledge of insecticides and their behaviour. Some pieces of modern equipment incorporate excellent mechanical ideas, but appear to have been developed by engineers with insufficient knowledge of insects and insecticides, and without prior consultation with experts in the pest control field. There is a fund of deep and practical knowledge available in this country on problems of insecticide application, and I feel that concerns who intend to enter the market with new equipment should spend considerably more time prior to production in consultation with these qualified people. This would avoid disappointment after production and would also save these concerns a great deal of money in modifications, which are always expensive after initial tooling up. Such basic information can be obtained at relatively little expense from Government research organisations and from insecticide manufacturers. In order, however, to make certain that the approach to such organisations will produce satisfactory co-operation it is essential that some proper scientific research should be done by the intending manufacturer in advance. The appointment of an experienced entomologist with a good working knowledge of insecticide theory and practice is, in my opinion, essential to such intending manufacturers.

A machine which is designed to deal with general pest problems cannot possibly deal with all problems that are likely to arise. I feel strongly that the intending equipment manufacturer should decide which problems are worth tackling and design his machine specifically for them instead of designing a machine and then finding out later what problems it can, or cannot deal with effectively. In such a way the type of failure could be avoided which reflects discredit on the machine, and on the insecticides used.

I am very much in favour of bright ideas being propagated which will assist in dealing with pest problems. The chemical industry themselves do, however, carefully evaluate the performance of their products before they are even mentioned in sales literature. A man with a pest problem is not interested in vague unsubstantiated claims either in literature or in advertising. If, for example, he sees a statement that a certain machine can be used to, say, control a particular parasite, he expects the machine to do the job. He doesn't want to have to carry out experiments.

I offer these comments in a sincere feeling that it is good advice to those who intend entering this market. I hope that my suggestions will be welcomed by the equipment industry, the insecticide industry and, by far the most important, those who use the products of both.

Yours faithfully,

J. M. HOPE,
Managing Director.

The Standardised Disinfectants Co. Ltd.
23 Sloane Street,
London, S.W.1.
January 20, 1954.

WORLD CROPS

IN OUR NEXT ISSUE T. B. Wilson will be writing on the **Economics of Peasant Cane Farming in Trinidad,** while **Banana and Citrus Fruit Importation into the Port of Bristol** will be described. **A Farmer Owned Fertiliser Plant in Mississippi** will be described by John Grindrod, and there will be an article on **Native Farming in Kenya** besides additional articles and the usual features.

The P.C.L. Slide Rule

We have received from Pest Control Limited an example of an ingenious slide rule which they have recently designed for computing dosage, pump delivery, swath width and speed in spraying operations. The instrument is contructed with a double slide and if three of the factors indicated above are known it is possible to compute the fourth very rapidly. In addition the lower two scales of the rule can also be used for simple multiplication and division as on an ordinary slide rule.

In these days when spraying is a matter of ordinary farming practice, this little apparatus should be extremely useful to farmers in making necessary calculations and be the means of saving much laborious arithmetic. The rule can be obtained on application to Pest Control Ltd., Bourn, Cambridge.

RESEARCH DEVELOPMENTS

Trace Elements in Tropical and Subtropical Soils

While much attention has been paid to the effect of deficiencies of trace elements in the soils of temperate regions, it is only of recent years that the question has begun to receive the attention which it obviously must merit in regard to the soils of the tropical and subtropical regions. The following review of certain aspects of recent work in this connection by Dr. Herbert Greene, Adviser on Tropical Soils at Rothamsted Experimental Station has been made available to us and is reproduced with his permission.

IT is reported in *Chemistry and Industry* for May 30, 1953 that Dr. J. Griffiths Davies, associate chief of C.S.I.R.O. Division of Plant Industry, Australia, has stated that research into deficiencies of trace elements in Australian soils may result in the dramatic improvement of 340 million acres of poor land in the areas of better rainfall.

Mineral deficiencies in Australia

Most of these areas had remained undeveloped because the cause of their infertility was not understood. It is now obvious that everywhere the most important deficiency was in nitrogen. This deficiency must be corrected by pastures based on legumes. In turn legumes could be grown only when mineral deficiencies were corrected. 'Copper, zinc, molybdenum and cobalt are some of the elements most commonly deficient,' said Dr. Davies, 'but it is also being shown that the long-established results from superphosphate are often due to the correction of deficiencies of sulphur and calcium as well as phosphorus.'

For comparison with this statement it may be noted that in 1949 the United Kingdom had 31 million acres under cultivation, including 19 million acres arable and 12 million permanent grass land, excluding rough grazing. Thus agricultural chemistry is creating in Australia from almost worthless land a fertile area about 11 times as great as the total of cultivated land within the United Kingdom.

These discoveries in Australia relate to areas of low relief having soils derived from the leached and lateritic residues of an earlier period of weathering. Prescott and Pendleton (1952) in Comm. Bur. Soil Sci. Technical Communication 47, dealing with Laterite and Lateritic soils, refer to the possibility that molybdenum and zinc are segregated with iron under conditions such as formerly prevailed in Western Australia and South Australia. This may prove to be a matter of far-reaching importance.

Sulphur deficiencies

The weathering of igneous rocks includes the absorption of water, the oxidation of ferrous iron and the washing away of more soluble constituents. In addition solid particles may be carried away and be deposited elsewhere. Chlorine and sulphur are mobile constituents of rock but whereas Cl is carried out to sea S is usually arrested by vegetation, for example, by sedges or mangroves in swamps or estuaries. As this vegetation accumulates or is buried beneath fresh mineral deposits there is built up a bed of material containing sulphur in various forms. If conditions subsequently permit air to enter this material part of the sulphur is quickly oxidised to form sulphuric acid in sufficient strength to attack clay and to form iron sulphate and aluminium sulphate. These substances can be transported in drainage waters and can hydrolyse. This may lead to separation of the sesquioxides in the form of lateritic deposits. Such movement and separation of iron may entrain other elements that are needed as micro-nutrients by plants or by micro-organisms on which some plants depend. Extreme acidity due to oxidation of sulphur contained in deposited materials has been observed in Australia (Prescott), Siam (Pendleton), Malaya (Wilshaw, Coulter), Uganda (Chenery), Sierra Leone (Dougall), Gambia (Greene), Nigeria (Doyne, Hartley and Watson) and in Sweden (Torstensson, Wiklander), Finland (Kivinen), Netherlands (Zuur, 1952) and probably in many other places. Geochemical changes involving sulphur may therefore be of wide occurrence. There are other ways in which movement and separation of iron may occur. The iron may go into solution and be transported as ferrous bicarbonate or as a complex with some organic material derived from plants. In these cases also there is a possibility that micro-nutrients may accompany the iron. Thus, as a result of these chemical and physical processes of rock weathering there is a possibility that sulphur and some micro-nutrients may be washed away from some areas and that micro-nutrients may be deposited elsewhere in forms not readily available to plants. If this is so, deficiency of plant nutrients may ensue both in the areas which are leached and in the areas where iron oxide is deposited.

There is a reasonable chance that the situation observed in Australia may be repeated within wide regions in Africa, South America and South Asia. In a review of sulphur deficiency W. Crocker (*Soil Sci.*, **60,** 149, 1945) notes that this is to be expected in humid areas distant from the smoke of industries and railways. J. E. McMurtrey (*U.S.D.A. Tec. Bull.* 612, 31, 1938) observed that tobacco grown in the field rarely shows symptoms of sulphur deficiency because this crop usually receives fertilisers containing sulphur. H. H. Storey and R. R. Leach reported sulphur deficiency in tea in Nyasaland (*Ann. Appl. Biol.* **20,** 23, 1933) and S. P. Aiyar, when working in Burma, observed sulphur deficiency in rice (*Indian J. Agr. Sci.*, **15,** 283, 1945). M. Greenwood (*Emp. J. Exp. Agr.*, **19,** 225, 1951) found in Northern Nigeria that groundnuts responded better to single superphosphate than to other types of phosphate and ascribed this difference to the gypsum content of superphosphate. He later obtained response to sulphur (applied as sodium sulphate) as well as to phosphorus (applied as sodium phosphate). While some soils gave direct response to sulphur others responded only after receiving phosphate. This was the stimulating sequel to K. T. Hartley's demonstration (*Emp. J. Exp. Agr.*, **5,** 254, 1937) that the spectacular returns produced by application of 1 ton/acre of pen manure to the soils of Zaria Province could equally be obtained by use of 50 lb. of superphosphate. This offers a suggestive resemblance to experience in Australia.

Deficiencies in East and West Africa

E. M. Chenery (unpublished observation) finds that citrus in Uganda seems to respond to magnesium plus copper and

zinc. It is thought that this condition may be due in part to presence of excess manganese. Greenwood and Hayfron (1951) have reported iron and zinc deficiencies in cocoa in the Gold Coast. R. A. Webb in the Gambia has obtained preliminary indications suggesting that commercial fertilisers will prove ineffective for groundnuts unless small amounts of manganese, copper and boron are added also. In the Gambia and elsewhere there is need for careful experiments, including major and minor plant nutrients.

Once such experiments begin to yield results it may be equally important to resist the temptation of throwing trace elements all over the place in the hope that miraculous growth will result. It may be that caution is particularly necessary in the tropics since the rather infrequent benefits obtained from applying lime to acid tropical soils suggest that the balance of plant nutrients may be rather easily upset by adding what proves to be excess of one element. It must be remembered that we have still much to learn about the use and functions of N P and K and it would therefore be rash to ignore the possibility of unexpected reactions when additions of several minor elements are made.

In his valuable book, *Manures and Fertilisers*, A. M. Smith remarks that a ' cake-fed dung ' has always been regarded as having a higher manurial value than a ' roots-and-hay ', and both chemical analyses and field experiments have supported this contention.

Nutrients in animal manures

It may be worth while adding that an application of animal manure may fail to supply a major nutrient or a micronutrient if these elements were deficient in the food the animals ate. Thus it was recently found in Antigua that though tomatoes responded notably to P N and K they did not respond to animal manure. Independent studies showed the animals were suffering from reproduction disorders. These were associated with thyroid trouble which has been cured by feeding iodine. Lack of some other element such as phosphorus or sulphur may have contributed to the illhealth of the animals and to the failure of the manure.

HERBERT GREENE

NEW BOOKS

Soil and Fertiliser Phosphorus in Crop Nutrition

Vol. IV of *Agronomy*. Edited by W. H. Pierre and A. G. Norman. Pp. xvi + 492. Academic Press. 1953. $9.00.

This is the fourth volume of the series sponsored by the American Society of Agronomy. It is based upon a three-day conference at Illinois in 1952, though the various papers are printed in expanded form and at least one paper has been added. It is a most timely survey of the current state of knowledge about phosphorus and crops for, as Pierre observes in the introduction, with most rapidly advancing fields there is occasional need ' to make a comprehensive and critical analysis or evaluation.' It may be that this book does not quite succeed in this objective, however, by being too voluminous; one is tempted to ask whether being comprehensive is the same thing as being critical. Is it not the task of specialists to do a little pruning? Frankly, it is somewhat difficult to regard the book as ' reader-stimulating,' though as a reference book for several years to come, it must take an important place on the shelves of any up-to-date agricultural science library.

The subjects dealt with are: ' Physiology and Biochemistry of Phosphorus in Green Plants ' (D. I. Arnon); ' Soil-Plant Relationships in the Phosphorus Nutrition of Plants ' (L. A. Dean and M. Fried); 'Inorganic Phosphorus in Acid and Neutral Soils ' (L. T. Kurtz); ' Inorganic Phosphorus in Alkaline and Calcareous Soils ' (S. R. Olsen); ' Organic Phosphorus in Soils ' (C. A. Black and C. A. I. Goring); ' Soil Tests for Phosphorus Availability ' (W. L. Nelson, A. Merhlich and E. Winters); ' Comparative Efficiency of Phosphate Fertilisers ' (H. T. Rogers, R. W. Pearson and L. Ensminger); ' Soil Management and Phosphorus Availability ' (G. Stanford and W. H. Pierre); ' Liming and Phosphorus Availability ' (E. Truog); ' Laboratory Evaluation of Phosphate Fertilisers ' (K. D. Jacob and W. L. Hill); ' Domestic Phosphate Deposits ' (V. E. McKelvey *et alia*); ' Phosphate Fertiliser Production in the U.S.' (J. L. Walthall and E. C. Houston); ' Phosphorus Status and Needs of U.S. Soils ' (F. W. Parker); ' Phosphate Usage in Great Britain ' (A. B. Stewart); and ' World Phosphorus Production, Consumption and Needs ' (V. Ignatieff and G. J. Callister). A lengthy and formidable menu indeed! The number of references cited in just one of these separate chapters is 130, the majority carrying dates after 1940.

It is scarcely necessary to say that these contributions are competently compiled, for the names of their authors are in themselves a guarantee. The inclusion of a paper by a British authority is pleasing, but this does not wholly offset the self-sufficient tendency of American science to refer almost entirely to American research when surveying a subject. Admittedly this book, like the original conference, is predominantly concerned with the phosphorus of U.S. soils and crops, but gains in knowledge about this element have a more universal origin. Granulation, a development that has been advanced far more in Britain than any other country in the past ten years, is discussed, but with the most limited reference to British papers. In the paper on world phosphorus production and consumption there is insufficient emphasis upon the long-term inadequacy of known rock phosphate deposits, presumably because the U.S., as one of the world's four main sources of high-grade reserves, is very much better placed. These are but minor points of criticism, and no author or group of authors could devote some 220,000 words to a major topic without encountering differences in opinion or judgment. Symposia of this all-embracing kind are for that reason so difficult to review with justice.

Perhaps the outstanding contribution is the first, the functions and movements of phosphorus *in plants*. All too often a nutrient is discussed only externally; here a most authoritative dissertation rightly takes the opening place, and much of the information given will be new to agricultural scientists. New, indeed, it mainly is, for about half the references given are dated 1950-52.

D.P.H.

Beef Cattle Husbandry

By Allan Fraser, M.D., D.Sc. Pp. 244. Crosby Lockwood. 1953. 18s.

This book is written by Dr. Allan Fraser, who is acknowledged as a leading authority on all animal husbandry questions. He is Lecturer in Animal and Dairy Husbandry at the University of Aberdeen. The book discusses most aspects of beef cattle raising under British conditions and also includes chapters on ' World Beef Trade,' ' Beef Breeding ' and ' Beef Policy.'

For students, farmers and all concerned with beef production the book will be found invaluable, since it provides full and expert treatment of aspects of an industry of vital importance at the present time to the agricultural economy of Great Britain.

Reports and Publications

The Fruit Annual, 1953-54

Edited by H. F. Tyser, pp. 518. London 1953. British Continental Press. Price 20s.

The 1953-54 edition of this yearbook of world trade in fresh, frozen, canned and dried fruit represents a distinct advance over its predecessors. It contains a valuable survey article on the fruit trade in the principal countries of the world as well as a number of other useful articles on such diverse subjects as deciduous fruit, citrus fruit, storage of apples, dried fruit, tropical fruit and edible nuts, as well as a useful article on quick freezing. The book also contains an encyclopaedic list of the principal varieties of fruit on the market.

The reference sections of the book include one which shows the months and the countries in which the principal kinds of fruit become available throughout the year, a glossary of terms in use in the fruit trade and a world directory of firms engaged in packing, canning, exporting and handling all kinds of fresh and dried fruit, also firms supplying machinery, equipment and packing materials and a buyers' guide. There is also a section listing the principal journals concerned with the fruit industry throughout the world.

The book itself is well presented, it is printed in English but in addition it also contains tables of contents printed in French, German, Spanish and Italian, as well as brief resumes of the more important articles in French and Spanish.

It forms an invaluable source of reference and information for all who are in any way connected with the industry of fruit production and the trade in all kinds of fruit and can be cordially recommended.

Pigs, Their Breeding, Feeding and Management

By V. C. Fishwick. Pp. 228. Crosby Lockwood. 1953. 18s.

This is the fifth edition of the late Mr. V. C. Fishwick's work on pigs. Mr. Fishwick died in January 1950 and the fifth edition has been edited by Mr. W. A. Biggar, Farm Director, Duthie Experimental Stock Farm, Aberdeen. The book preserves the character of the original, notably its simplicity and practical outlook. It is essentially the work of men who know the business of pig raising from A to Z and is an essential and valuable guide to all matters connected with pig raising. The book itself is well printed and is illustrated by a large number of excellently reproduced photographs.

It should be in the hands of all pig raisers.

Annual Report of the West African Cocoa Research Institute for 1952-53. Published for the Institute by the Crown Agents for the Colonies, 1953, price 5s.

It is now just ten years since the West African Cocoa Research Institute was hurriedly organised on a joint West African basis primarily in order to provide the means of investigating the disease complex known as swollen shoot and, if possible, devising effective methods of combating it, but also to investigate the numerous unsolved problems attending cocoa cultivation in the West African environment. It must be admitted that the results which have attended the work of the Institute during the intervening period have been at first sight somewhat disappointing, for although it has been demonstrated that by using the somewhat drastic method of cutting out it is possible to control or at least to keep in check the spread of the swollen shoot disease, and while effective methods of controlling the capsid bug *Distantiella theobroma*, which attacks cocoa in the early stages of growth, have emerged, the Institute has so far failed to devise satisfactory methods of combating *Sahlbergella singularis* which attacks mature trees and is by far the most destructive of the capsid enemies of cocoa in West Africa. Moreover, the Institute has made no very effective progress so far in solving the numerous other problems, including the manurial requirement of the crop under West African conditions, which were listed in the programmes of work drawn up by the Cocoa Research Conference convened by the Colonial Office in 1945.

In justice to the Institute it must of course be conceded that throughout its career it has suffered continuously from shortages of trained staff, while added to this it has frequently happened that available staff have accepted transfers to other fields of activity just when their work in West Africa showed signs of becoming fully effective.

In these circumstances it is a matter for satisfaction that in the report under review it is recorded that the position in regard to senior staff is at last showing signs of material improvement, in fact, at the time the report was written it appears that all the posts included in the senior staff list had been filled. It is to be hoped that this will be the prelude to more extensive operations in a number of directions and indeed the report indicates that this is likely to be the case.

In regard to swollen shoot disease, no new susceptible wild hosts for the disease have been discovered but the collection of strains of swollen shoot virus has been enlarged by the inclusion of a number of new ones, indeed it is a matter for amazement how many different strains of virus have been found to exist in the West African jungles.

Much detailed work is recorded in regard to the transmission of the virus by mealy bugs, including work with systemic insecticides, in which the Institute has collaborated with the team of research workers from Pest Control Ltd. Tests seem to show that 'Dimefox' (bis dimethyl amino fluor phosphine oxide) is the most effective.

The ant mealybug complex has received attention and tests are in progress to compare the attractiveness of various substances to the ants which attend mealy bugs and assist their spread, while work is also in progress on labelling mealy bugs with radio-active tracers with a view to tracing their migrations. Large numbers of parasites of mealy bugs, totalling 208,546 have been introduced and liberated in the hopes of establishing control, while the collection of local parasites and predators has continued. Chemical control of capsids has received attention and good results are reported from dusting with DDT using a power duster manufactured in Switzerland.

Some indeterminate results are reported from manuring with various forms of phosphatic fertiliser and uniformity trials are in progress with a view to selecting sites for larger scale manurial trials in the future. There has been activity in plant breeding, progeny trials have shown that a number of new strains show promise, while clonal trials are said also to show promise. A large number of cross pollinations have been made with a view to elucidating problems in connection with the breeding of *Theobroma cacao*.

Much attention has also been devoted to the problem of black pod disease control which is a source of serious loss in cocoa in West Africa, and control spraying experiments have been concluded. Other work has included chemical work on swollen shoot disease, analysis of mealy bug secretions and work on the flavour of cocoa.

It is obvious that the scope of the work of the Institute has considerably extended during the year, the result no doubt of the increased staff available. It is to be hoped that it will be possible to maintain the staff at full strength and the consequent scale and tempo of the research operations.

H.T.

Tropical Agriculture

'Tropical Agriculture,' the journal of the Imperial College of Tropical Agriculture, has with its number issued in January 1953 once more undergone a change in its appearance and the circumstances under which it is published. The impending changes were announced in the preceding number which appeared in October last, and with the present number the appearance of the publication has been slightly modified, but the main change appears to be that it becomes essentially a vehicle for the publication of original papers on tropical agriculture. Its place of publication has been transferred from Trinidad to London, while the editorship has been confided to the hands of Mr. G. B. Masefield, M.A., of the Oxford School of Agriculture, with the assistance and advice of an editorial board which includes a number of scientists who have attained eminence in the tropical agricultural sphere.

The papers in the present issue are of diversified interest and include such varied topics as Sir Frank Engledow's address on colonial agricultural policy to the recent Colonial Office Conference of Directors of Agriculture and articles on termite control, rice research in Sierra Leone, the teaching of tropical agriculture, land settlement in Nigeria, pepper cultivation in Sarawak, etc.

It is with regret one notices, however, that all reference to the activities of the Imperial College itself is omitted. This seems unfortunate inasmuch as the work and standing of the College are sufficiently important to justify periodic reference thereto in what is after all its own publication, and we suggest the omission should be repaired in subsequent issues.

We offer our best wishes to 'Tropical Agriculture' for a successful career of usefulness in its new guise.

The Edward Curran Companies

We have received from the Edward Curran Engineering Co. Ltd. a copy of the history of the Edward Curran Companies within the last 50 years. The undertakings have been, throughout their existence, iron founders and, particularly in their early days, manufacturers of armament materials. In later years, however, they have become more and more concerned with the manufacture of machinery and equipment used in agriculture. At the conclusion of the book it is stated that 'Bearing in mind the lessons of the past, our main task in the future must be to maintain the inventive adaptability of Edward Curran and his brothers,' which has helped the firm to build up the position they now occupy.

British Books for the U.S.A.

In view of recent somewhat adverse criticism in the daily press of British technical books, the picture on the left is of interest. It shows the Chairman Mr. W. Leonard Hill, (*left*) and Mr. R. Thixton, Export Manager, (*right*) of Leonard Hill Ltd., with Mr. Edward Curr, (*centre*) author of 'A Practical Manual of Medical and Biological Staining Techniques', published by this firm. They are viewing a large consignment of his book, at the docks, in transit for the United States. Mr. Curr is a recognised authority on biological stains and reagents and he is founder and managing director of Edward Curr Ltd., makers of Michrome biological stains.

The International Society of Soil Science

We have received copies of the transactions of the joint meetings of Commission No. 2 and Commission No. 4 of the International Society of Soil Science, which met in Dublin in July 1952. The appearance of these reports occurs some time after the holding of the conference to which they relate; the two volumes contain a number of important and valuable papers by a large number of acknowledged authorities in soil science, including such well-known names as D. J. Nicholas, E. J. Hewitt, T. N. Jewitt, Prof. T. Wallace, W. Morley Davies and a number of others, while the papers include such varied subjects as base exchange, soil survey methods, field experimentation and so forth.

European Agricultural Films

For the first time in the rather short history of communicating agricultural information on a European level, a 'European film' on maize has been produced and will be released soon. This has been done by the United States Foreign Operations Administration (F.O.A.), Paris. On a contract basis, a London Company prepared the script, photographed and edited the film in consultation with Food and Agriculture Officers of F.O.A.

In the past it was considered almost impossible to produce a good film with wide appeal to farmers throughout Europe. It is hoped, however, that this new film on maize will show that the job can be done, and that a film of this type can serve efficiently as a teaching aid for maize producing countries in Europe, even those with entirely different planting, harvesting and processing methods.

The film was shot in northern Italy, France and the Netherlands, where soils and climate are sufficiently diverse to permit of generalisations which will be useful in other countries. It consists of three parts, each with a showing time of about 25 minutes. The first part, 'Planning the Crop,' gives a detailed introduction to the theory of growing maize. Mutual co-operation between farmers, farm advisers and seed suppliers is emphasised and the importance of hybrid seed pictorially demonstrated. The second part, 'Production Practices,' deals with planting and cultivation practices and shows different methods and techniques used in various parts of Europe. The third part, 'Harvesting,' deals particularly with effective harvesting, husking and storage methods, while special emphasis is given to the use of corn cribs as a means of cutting down harvesting losses.

Chicle

(*continued from page* 121)

moisture is driven out. It is then shaped into blocks which are stamped with the chiclero's mark before they harden.

Exports of chicle from British Honduras have tended to diminish of late years. The exports for the ten years ending 1949, excluding the war years, are shown below, they are taken from the *Economic Survey of the Colonial Empire*, Vol. VII, published in 1952 by H.M. Stationery Office.

	cwt.
1938	7,861
1939	7,296
1946	10,254
1947	12,683
1948	9,330
1949	6,177

FARM MACHINERY

Electrical Seed Belt Indicator

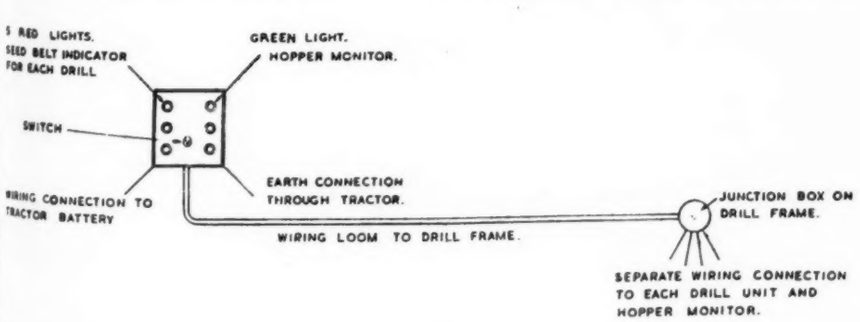
When seed drilling it is virtually important to know that the seed is going into the ground, and for this reason it is essential to have a man behind the drill. This is all very well with drills where the seed can be seen dropping, but the advent of the precision drills has made the task of the drill man more difficult. But now Stanhay (Ashford) Ltd. (export agents, S. Berendsen Ltd.) states that it has completed its electrical control so that the drill man can be dispensed with entirely. The company thinks that this is a big forward step and believes that now for the first time the tractor driver can have with this electrical seed belt indicator and hopper monitor full control of the drill behind him and know that it is drilling properly without turning round.

Each drill unit (each row) is fitted with a contact ' make and break,' which is operated by the moving seed belt. This contact is connected by an individual cable from each unit to a junction box fitted to the drill frame or toolbar. A six-core totally-enclosed wiring loom is run from the junction box to the control panel which is fixed to the tractor in front of the tractor driver. The control panel makes its own earth connection through the tractor and a single cable is connected from the panel to the live battery wiring of tractor.

The control panel is fitted with four or five red lights (according to the number of rows being drilled) and one green light. All the time the seed belt is turning in each drill unit it is making and breaking contact and thus keeping the appropriate red lights flashing on and off. If anything at all should happen to stop the seed belt turning (and thus stop the seed being drilled) the light immediately stops flashing —remaining either on or off. The tractor driver then knows that there is something wrong and also which drill to go to.

The hopper monitor is only fitted to one master hopper, as the seed is emptied from all of them at the same rate. The ' master ' hopper should have slightly less seed in it than the others. A float is automatically released as soon as the lid is put on to the hopper which falls on the top of the seed and brings up the green light on the control panel. It goes down inside the hopper with the seed and breaks contact when the seed is getting low, thus putting out the green light. There is a good safety margin allowed to enable the driver to get to the head land, and he should then top up the seed in all hoppers.

It is claimed that the electrical control is more effective than a man behind the drill, as it is working inside the drill with the drill mechanism and ' sees ' what the man would not possibly see. It is also always alert and cannot fail to report any trouble.

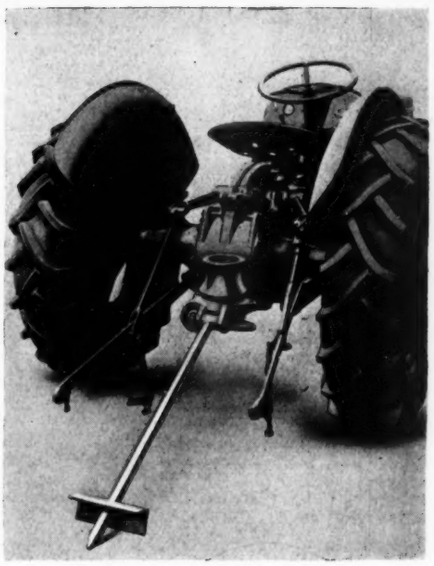

5 RED LIGHTS.
SEED BELT INDICATOR FOR EACH DRILL
GREEN LIGHT.
HOPPER MONITOR.
SWITCH
EARTH CONNECTION THROUGH TRACTOR.
WIRING CONNECTION TO TRACTOR BATTERY
JUNCTION BOX ON DRILL FRAME.
WIRING LOOM TO DRILL FRAME.
SEPARATE WIRING CONNECTION TO EACH DRILL UNIT AND HOPPER MONITOR.

The Stanhay Electrical Seed Belt Indicator in diagram form

Mounted Tractor Capstan

The Hudson-Colquhoun mounted tractor capstan has been designed to deal with those hundred and one awkward jobs about the farm which at the moment require either expensive equipment or laborious hand work. It can be easily fitted horizontally or vertically to the power take-off on the tractor and can be used at the same time as the hydraulic linkage pick-up hook, etc., and need only be dismounted if one of the p.t.o.-operated implements are used.

The company states that the small farmer will find this little implement a boon, giving him the extra strength previously afforded by quite a few strong arms. To operate the capstan is said to be simple: simply let down the spray arm and engage p.t.o. in gear, when capstan drum will commence to turn. Take a complete turn or two round drum with rope or wire cable and pull tight. The strength of pull can be varied by slackening or tightening the rope. At the present moment the implement is being made to fit the Ferguson tractor, but will be adapted for other makes in the very near future. The implement is produced by Kenneth Hudson and Son.

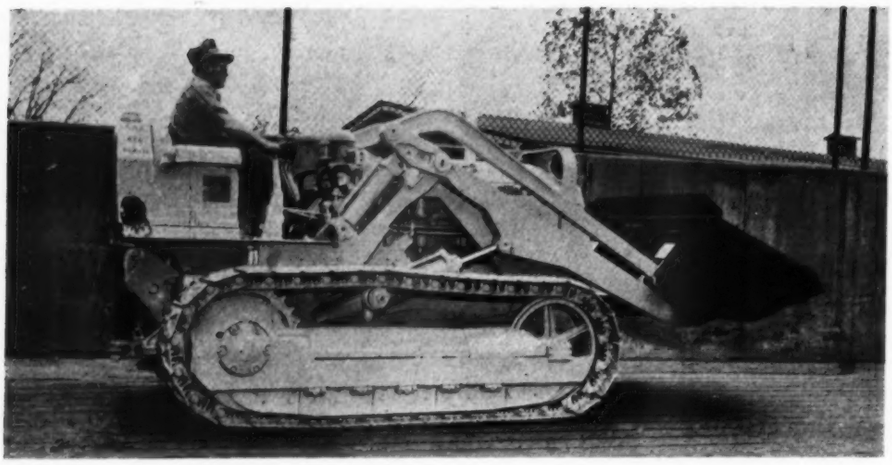


The mounted tractor capstan

Attachments for the Crawler Tractor

The crawler tractor is not just a bulldozer or a simple prime mover, many owners have found after investigating the wide number of attachments available. Manufacturers have brought out a variety of useful attachments ranging from front end pull hooks to starting aids in an effort to make the track-type tractor more versatile and to make operation easier.

The crawler tractor is often subjected to certain strenuous jobs that may in some way endanger the machine or some part of it. Or the owner may hesitate to use his tractor on a certain job for fear of damaging it. In cases such as these, special attachments may be purchased to protect the machine and thus keep costly downtime due to breakage at a minimum. For example, a heavy-duty radiator guard is a precaution against tree limbs and brush on a logging operation. Or, if the tractor is operating under severe conditions, an extra heavy-duty track roller guard will protect the track rollers from damage. Rocks and stumps also prove a working hazard and a crankcase guard is protection against damage to the underpart of the engine and transmission. Various types of guards are also provided to protect the tractor engine from tree limbs or branches.



A Caterpillar HT4 shovel with a new top-position bucket

Often operations are near dry underbrush, timber, grain, oilfields or storage tanks of inflammable materials where a spark from the exhaust may prove very costly. A spark arrester has been developed that practically eliminates all danger from this source.

Tractor shoes and push cups

The crawler tractor is required to travel over many types of surfaces in performing its job. Tractor manufacturers have done considerable research to provide owners with special shoes to adapt their track-type tractors to these various surfaces. Grousers of different sizes, skeleton shoes, snow and ice shoes, street plates and rubber shoes are but a few of the many types of shoes available for special jobs.

Special attachments provided for construction and other jobs include push cups that give good in-line power for pusher tractors. These push cups may either be mounted to a U-frame in front of the tractor or attached directly to the dozer blade so that the tractor can be used not only as a pusher but also as a bulldozer. A front pull hook is also available and may be used where heavy-duty equipment is being towed and it is desirable to hook tractors in tandem. A front bumper may also be attached to protect the tractor radiator from heavy bumps or jolts.

Attachments

A large variety of agriculture attachments to be used with track-type tractors are now offered the farmer. Such attachments include tool-bar arrangements, subsoilers, disc ridgers, cultivators, ditchers, chisels, furrowers and pivoting lister shanks. Using these attachments in conjunction with the powerful diesel track-type tractors, it is stated that the farmer can till his soil profitably under any conditions.

Manufacturers of track-type tractors are making it possible for farmers to keep their machines busy during slack seasons through the use of special attachments such as the following. A belt pulley drive attachment will allow a crawler tractor to do such jobs as driving a sawmill, thresher or ensilage cutter. A rear power take-off may also be attached for special jobs, or the tractor owner may obtain the doubly-useful combination of both the rear power take-off and belt pulley drive. Then, too, there is a front power take-off available for use in driving auxiliary equipment such as generators, pumps and winches. For orchard work, also, a special orchard-type exhaust may be used to discharge exhaust gases downward below the fenders and thus keep the exhaust from striking tree limbs or fruit and damaging them. Lights, too, are available for that round-the-clock schedule that so many crawler tractor owners must maintain.

Operator comfort

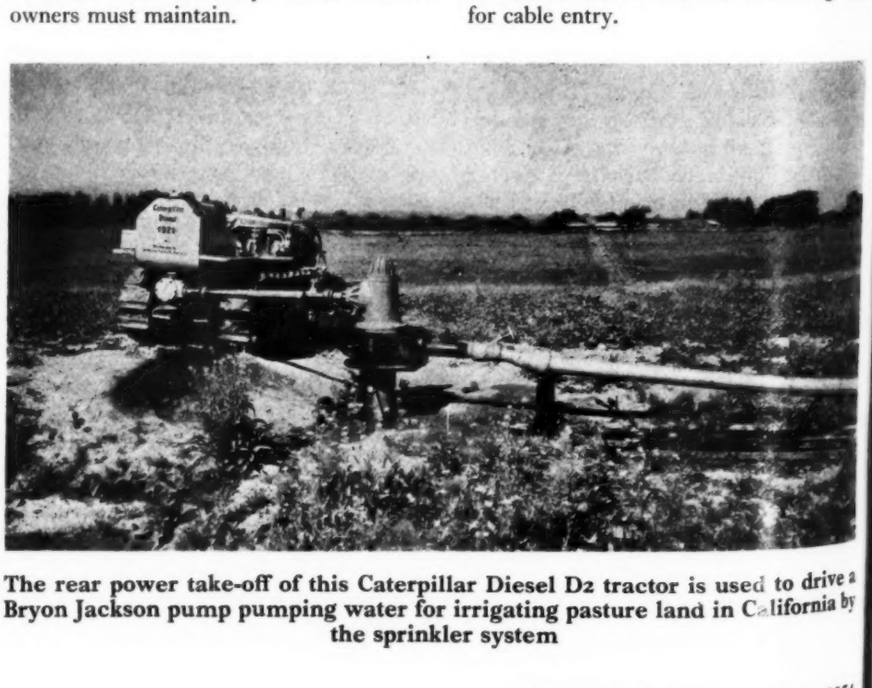
The comfort and convenience of the operator is too often overlooked in the operation of a track-type tractor. The tractor manufacturers realise this and provide special attachments to remedy the situation. For convenience where a gasoline starting engine is used to start a diesel engine, an electrical starting unit may be attached to the starting engine. Or, if it is extremely cold, an ether starting aid is designed to assist the starting of the diesel engine.

For the comfort of the operator, cabs have been designed to keep out the blizzards, sharp winds and other discomforts of winter. A heater may be installed in the cab to keep the operator warm. To shield the operator from the sun and to provide shelter during showers or sudden downpours, a canopy top may be purchased.

Lighting Fitting

A new ceiling fitting for fluorescent lighting—the 'Athlone'—using 5-ft. 80-watt lamps, has recently been produced by Philips Electrical Ltd. It is especially designed for rapid and easy fixing at any centre from 36 in. to 51 in. and all control gear and wiring are mounted on an independent gear chassis extending the full length and width of the reflector covers. This arrangement is said to lend to the fitting a smooth, clean line, unmarred by a projecting starter switch.

Although designed for flush ceiling mounting, it can be suspended by chain or by conduit as well. In addition, provision is made in the centre of the gear chassis for B.S.S. conduit box fixing, and for cable entry.



The rear power take-off of this Caterpillar Diesel D2 tractor is used to drive a Bryon Jackson pump pumping water for irrigating pasture land in California by the sprinkler system

WORLD CROP REPORTS

PAKISTAN

Rice prospects. Pakistan's first official forecast of rice acreage in 1953-54 is 23,447,000 acres, an increase of 7.6% as compared with the first forecast of 21,801,000 acres in the corresponding period of a year earlier. The acreage reported in the final forecast of 1952-53 was 23,016,000 acres.

Except in Northwest Frontier Province, there has been a general increase in the acreage of this crop throughout Pakistan, which is attributed partly to favourable weather and sufficient supply of water at the time of sowing, and partly to the Grow More Food Campaign. By far the largest increase occurred in East Bengal, which is due to a reduction in jute acreage, reclamation of waste land and high price of rice. The condition of the crop was reported quite satisfactory at the end of November.

This forecast does not cover the total area sown to rice in Pakistan during 1953-54. Using about the same allowance as last year of 1,200,000 acres planted within the months between the first and final forecasts, the total rice acreage which may be planted in 1953-54 adds to 24,600,000 acres. Given only average yields on this area, a crop of around 30,000 million lb. of rough rice would be harvested. This is larger than had been expected.

SOUTHERN RHODESIA

Agricultural production. The gross value—representing the money received by farmers for crops and other commodities—of Southern Rhodesia's agricultural output rose from £3,770,000 in 1938 to £34,010,000 in 1952, it is shown in figures published in Salisbury by the Central African Statistical Office. The gross value of pastoral and dairying products produced by farmers increased 372% and crops and orchard products by 1,083%. All farming produce, including animal husbandry, pastoral and orchard products, increased by 802%. The volume of agricultural output rose by 168%. This growth in volume, says the report, was influenced to a very much greater extent by the increase in the volume of the crops group—201% above the 1938 level—than by the increase in the pastoral group, which showed a rise of only 71% in the same period. The most important factors responsible for the rapid increase in the crops group during recent years were tobacco and cotton. Maize and potatoes were the only other crops to show any material increase during 1952. The report states that, in general, the volume of agricultural production has more than kept pace with the growth of the country's population, the exceptions being in unfavourable seasons. It does not follow, however, that a particular section of agriculture (the volume of production of foodstuffs, for example) has kept pace with the growth of consumption. The volume of mineral production has failed to keep pace with, and that of manufacturing industries has outstripped, the growth of population. The gross values of various types of agricultural produce for 1952 follow, with the 1938 figures in brackets: Tobacco, £17,286,000 (£1,132,000); maize, £5,554,000 (£621,000); 'cattle slaughterings,' £4,013,000 (£832,000); dairy produce, £1,082,000 (£199,000).

URUGUAY

Wheat. Uruguay expects to harvest its largest wheat crop in history this season largely due to a high guaranteed price to producers, according to the International Federation of Agricultural Producers. Reports indicate that Uruguay has a wheat acreage of 1.5 million acres. In 1952 1.3 million acres were planted. The guaranteed price to wheat producers is 16.5 pesos per 100 kg., which would be equal to about $2.52 per bushel at the official exchange rate. This relatively high guaranteed price has encouraged wheat seeding at the expense of other crops having a less assured future.

Uruguay expects to have a wheat surplus during this crop year of about 200,000 metric tons. Brazil has been given priority for the sale of the entire surplus.

IRAN AND IRAQ

Date crop. The 1953 date crop in Iran and Iraq is estimated at 437,500 short tons, compared with 542,900 short tons in 1952 and 521,900 short tons in 1951. This preliminary estimate is 13% less than the five-year (1946-50) average of 501,440 tons.

The crop in Iran (137,500) is equal to the average production of the past five years and is considered normal. It is lower than the 1953 crop chiefly because of the alternation in high and low production peculiar to the crop. In Iraq the size of the crop (300,000 tons) was influenced by a number of factors including fungus, premature falling of dates and an infestation of red spiders. However, the weather was favourable during the ripening season and the individual dates appear larger and better in quality than usual. Despite the overall shortage in the Basra area of Iraq, production of Hallawi dates will be much above normal. This is the choicest variety and the type shipped to the United States and Canadian markets. Iranian stocks of dried dates were negligible at the end of the 1952-53 season and stocks on hand in Iraq were scattered and probably amounted to only a few thousand tons.

It is now believed that a total of 33,000 short tons of dried dates were exported from Iran during the 1952 season, almost 85% of which were shipped during the first seven months of the crop year. Trade sources expect that an equal amount will be shipped in 1953-54, despite the small size of the crop. The estimate of this year's trade is an expression of the pressure that probably will be made on exports because of the fiscal position of the country.

The trade of Iraq reports almost 290,000 short tons of dates exported through the port of Basra during the 1952-53 season. While the exportable surplus during the current season probably will not exceed 200,000 tons, the decrease in exports will be partially offset by a reported decline in the world demand for basket-packed dates.

Exports of boxed dates are expected to total almost 50,000 short tons this season, according to agreements reached in London in April 1953 between the Iraq Dates Trading Co., the Date Association and foreign buyers. Of this total, about 18,800 tons were for the United States, 18,800 tons for the United Kingdom and Europe, 5,500 tons for Canada and 6,600 tons for the Union of South Africa, Australia and New Zealand.

(*Foreign Crops and Markets*)

BRAZIL

Nut production. The 1953 estimate of Brazil nut production in Brazil remains at 33,000 short tons, unshelled basis, compared with 18,700 tons in 1952 and 33,000 tons in 1951. The estimate is 66% higher than the ten-year (1941-50) average of 19,900 tons and 22% higher than the five-year (1946-50) average of 27,100 tons. The trend of nut stocks entering the market and of exports verified through September 31 indicates that the final distribution of the current crop by export districts will be as follows: Belem, 19,500 tons; Manaus, 12,800 tons; Itacoatiara, 400 tons; Parintins, 200 tons and Santarem, 100 tons. During the 1952 season, collections in Belem were 11,900 tons, Manaus, 6,600 tons, and the balance of 200 tons in Itacotiara. Despite the compensatory prices being paid by exporters to pro-

ducers, no significant changes in the above 1953 crop distribution and total forecast is expected.

Available stocks of unshelled nuts at Amazon exporting ports were almost exhausted by the end of September 1953. At that time from 2,200 to 3,300 short tons of unshelled nuts were awaiting shipment from Belem to Germany. Existing stocks of unshelled nuts are at present in the shelling process at plants in Belem and Manaus. It was estimated that from 5,000 to 7,000 cases of 66 lb. each (165 to 230 tons) of shelled nuts, which were contracted for by United States' importers, were being prepared for shipment before the end of November 1953.

Preliminary statistics show that, during the first nine months of 1953, a total of 19,579 short tons of unshelled and 4,057 tons of shelled Brazil nuts were exported from Brazil, compared with 10,908 tons of unshelled and 2,349 tons of shelled Brazil nuts during the comparable period of 1952. Of the 1953 shipments, the United States took 10,973 tons of unshelled and 3,048 tons of shelled; the United Kingdom took 6,937 tons of unshelled and 877 tons of shelled; Germany took 1,401 tons of unshelled and 9 tons of shelled; and other importers received 268 tons of unshelled and 123 tons of shelled Brazil nuts.

WORLD

Rice prospects. Each successive crop report from Japan has lowered the estimated yield of the rice harvest, which is the worst one that country has had for nearly 20 years. The out-turn is now placed at the equivalent of about 10 million tons of paddy. This represents a fall of almost 2.5 million tons, compared to 1952. In Europe there have been decidedly better reports from Spain, but the Italian crop is now estimated at slightly less than last year's. Elsewhere, however, most other countries report better rice crops. Particularly favourable reports come from India. In all the other countries of southern Asia, too, prospects so far are favourable. The area sown to rice is believed to have been increased in all of them—in some regions substantially—and weather conditions have been auspicious except in Cambodia and parts of Viet Nam. However, most of these crops are not yet harvested. In more northern Asian countries, *e.g.* Iran, Iraq and Turkey, the harvest is completed, and preliminary reports speak of out-turns at least as high as those of 1952. The same is true of South Korea which, although so near to Japan, escaped the climatic afflictions of the latter. Reports from mainland China are of a conflicting nature; according to the United States Department of Agriculture, indications point to a decrease below the out-turn of 1952 because of unfavourable weather.

In North America better news from California has led to a further increase in the estimated yield of the United States record crop, which is now calculated to be 2,328,000 tons. There has been a further notable expansion in the rice acreage in Cuba and production is expected to reach 170,000 tons, which represents a rise of 34% over 1952 or an eightfold increase over the pre-war average.

REVISED PRELIMINARY ESTIMATES OF RICE PRODUCTION IN SELECTED COUNTRIES, 1953-54, COMPARED WITH 1951-52 AND 1952-53

Country	1951-52	1952-53	1953-54
	Thousand metric tons, paddy		
Japan	11,302	12,404	10,028
Korea, South ..	*2,560	*2,900	*3,100
United States ..	2,077	2,207	2,328
Italy	750	863	834
Egypt	620	517	*612
Spain	285	325	387
Mexico	180	*137	*150
Portugal	141	131	117
Cuba	*117	*126	*170
Turkey	107	158	142
France	70	89	*70
Greece	56	75	67

*Unofficial estimate

Coffee developments. In 1953, coffee prices, for the fourth consecutive year, were relatively stable at levels higher than ever before. Three main reasons are responsible for this situation: world production is still below the pre-war volume, demand continued strong both in the United States and in European markets, and the overall reduction of stocks forced buyers to rely on current supplies.

World production in 1953 is estimated at 2,370,000 tons which, though still slightly below pre-war (2,420,000 tons) was about 6% higher than in 1951. For the 1953 harvest, only tentative crop forecasts are at present available for the Latin-American mild coffee countries and Africa.

In Brazil, total output was officially estimated before the frosts at 1,166,000 tons. It is claimed to have suffered only slightly from the frosts, but quality appears to be disappointing. After the bumper crops gathered in 1952 in Costa Rica, El Salvador and Mexico, harvests in 1953-54 are expected to be lower. Not more than an average size crop is anticipated in Colombia where untimely rains interfered with early harvesting operations. British East Africa suffered from drought in 1953, but in the other African growing regions, and particularly in French West Africa, output is likely to improve. No substantial increase can be expected in Indonesia's coffee production. If the world's 1953-54 crop should show an increase over 1952-53—which at present appears doubtful—the increase is likely to come from African rather than Latin-American growing countries.

COFFEE PRODUCTION

Region	1950-51	1951-52	1952-53	1953-54*
	Thousand metric tons			
North & Central America	357.0	359.0	402.0	380.0
Brazil ..	1,071.4	1,080.2	1,156.6	†1,166.0
Colombia ..	337.8	320.0	339.0	340.0
Other South American countries ..	63.6	62.1	82.7	67.4
Total, Latin America ..	1,829.8	1,821.3	1,980.3	1,953.4
Asia ..	71.0	82.0	74.0	78.0
Africa ..	291.0	321.0	308.0	330.0
Oceania ..	6.0	5.0	5.0	5.0
World total	2,200.0	2,230.0	2,370.0	2,366.0

*Preliminary estimate
†Estimate of May 1953 before the frost

Tobacco. Because of stricter acreage restrictions for the 1953 crop the total area under tobacco in the United States decreased 6.7% from 1952. The official October 1 estimate of production for 1953-54 is 922,000 tons, or 100,000 tons less than in the previous season. For the principal cigarette types (flue-cured and Burley), area and production have decreased respectively 8% and 11%. As stocks, however, were 100,000 tons higher than a year ago, total supplies in the United States are likely to be adequate, particularly as the general outlook for export is less favourable than in 1952-53.

Although the area under tobacco in Canada increased 10% this year, production at 57,000 tons was 6,000 tons less than in 1952. Among other major suppliers of cigarette tobacco for the export market, Southern Rhodesia harvested in the spring of 1953 a record crop of 47,700 tons against 43,800 tons in early 1952, but exportable supplies of flue-cured Virginia tobacco from India are expected to be lower than last year, although India's production of all types of leaf has increased.

Output of oriental leaf in 1953 in both Greece and Turkey is substantially higher than last year. The Greek production increased from 42,000 to 61,000 tons and that of Turkey from 90,000 to approximately 120,000 tons. This may increase exportable supplies by 40-50,000 tons and it is likely that stocks of oriental tobacco will accumulate again. Other countries in western and southern Europe, which produce mainly cigarette tobacco, expect an output of 197,000 tons, against 181,000 tons in 1952. Crop estimates for the principal producers of cigar tobacco (Brazil, Cuba and Indonesia) are not yet available. The United States crop of cigar tobacco is lower. Shortage of cigar leaves in European importing countries is likely to continue.

(*FAO Bulletin of Agricultural Economics and Statistics*)